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THE ANTIGENIC EFFICIENCY OF PULPY KIDNEY DISEASE VACCINES

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During recent years there has been a marked increase in the incidence of pulpy kidney disease (enterotoxaemia), both in adult sheep and in fattening lambs. It is now generally accepted that this disease is due to the absorption from the bowel of epsilon toxin produced by the very rapid growth of *Clostridium welchii*, type D. This organism is present in the intestinal tract of many normal sheep (Bullen, 1952), and the factors which determine its sudden and rapid multiplication are not fully understood. Field evidence strongly suggests that modern methods of grassland management and the intensive systems employed for the fattening of lambs tend to precipitate the onset of this disease.

The control of pulpy kidney disease by active immunisation has become a matter of considerable economic importance, and it was for this reason that the work here described was undertaken.

Short-term protection can readily be conferred on sheep and lambs by injecting them with the specific antiserum containing *Cl. welchii* epsilon antitoxin prepared in horses. The passive immunity thus conferred is necessarily of short duration and the repeated injections required to maintain it would be very uneconomical in those areas in which the disease occurs all the year round. Bennetts in Australia (1936) and Bythell & Parker in this country (1946) have shown that vaccination with *Cl. welchii* type D formolised culture is effective in reducing losses, but it is known to the writers that breakdowns have occurred in flocks treated in this way, possibly because the level of circulating epsilon antitoxin induced was not sufficiently high.

Since the use of specific antiserum is so effective, it is safe to assume that an adequate level of epsilon antitoxin is the most important requirement in the control of the disease. There is, therefore, no necessity to use anaculture, *i.e.*, formolised whole culture, if toxoid is as good or better for stimulating the production of epsilon antitoxin. As the number of units of epsilon antitoxin in a prophylactic dose of serum is known, it is possible to make a rough approximation of the lowest level of circulating antitoxin resulting from such a dose which will give protection for three to four weeks. This appears to be of the order of 0·10 unit per ml.

Our aim in this work was to determine which of the available antigens gives the highest and best maintained level of circulating antitoxin.

EXPERIMENTAL PROCEDURE

MATERIALS USED

Four types of *Cl. welchii* type D antigen of approximately equal combining power (Lf) were used in these experiments and in the tables will be designated by the following abbreviations :—

F.C. = Anaculture (formolised whole culture) = Pulpy kidney vaccine.
T.P. = Alum precipitated toxoid.
F.C.P. = Anaculture + 1 per cent. potash alum.
T.T.P. = Alum precipitated activated (trypsin treated) toxoid (Bosworth & Glover, 1934–35).

FLOCKS

In these experiments three flocks of sheep from widely separated areas, namely, Newcastle upon Tyne, Ross-on-Wye and Beckenham were used. It was clear from an examination of serum samples taken before any injections were made that we were dealing with two types of population (Table I). In the Newcastle upon Tyne flock the majority of the sheep had a fair degree of natural immunity, whilst in the Ross-on-Wye and Beckenham flocks very few animals had any detectable circulating antitoxin. The significance of this was evident in the difference in the response of the two types of flock to injection with the same antigen, although the relative efficiency of the antigens was independent of the type of flock in which they were used.

TABLE I
THE IMMUNE STATE OF THE FLOCKS AT THE BEGINNING OF THE EXPERIMENTS

Location	Percentage having titres of ε antitoxin		No. of sheep
	<0·01 unit per ml.	>0·10 unit per ml.	
Newcastle (Tables II and VI)	15·0	62·5	40
Ross-on-Wye (Table III)	64·0	10·2	39
Beckenham (Tables IV and V)	75·9	5·0	60

METHOD OF COMPARISON

A comparison of the antigenic efficiency of the four preparations was made by measuring the concentration of epsilon antitoxin in serum samples taken from the sheep at the following times during the course of immunisation :—

1. Twenty-eight days after the first and at the time of the second injection, showing the response to one injection.
2. Fourteen days after the second injection (except in the case of the Newcastle flock where, unfortunately, it was not possible to take this sample) showing the values obtained at or about the peak of the secondary response.
3. At suitable intervals thereafter in order to follow the duration of the immunity in the sheep.
4. In the Newcastle flock at the time of a third injection given to half the flock.
5. Fourteen days after this injection to find the effect of a boosting dose given 33 weeks after the initial double vaccination.

The antitoxin content of the sera is recorded in terms of the provisional unit which had always been used in these laboratories and which we have found to be equal to 0·75 of an Australian unit as used by Turner & Rodwell (1943) and approximately 10 times the unit used in America by Baldwin *et al.* (1948), deMello *et al.* (1952).

The course of immunisation consisted of two subcutaneous injections of 5 ml. of the appropriate antigen (except in the experiment recorded in Table V, when a comparison was

made between two doses of 5 ml. and two doses of 2 ml.) given at an interval of four weeks. The boosting dose given to the Newcastle upon Tyne flock was also 5 ml.

Results

The results given in Table II show that alum precipitated activated toxoid (T.T.P.) was a better antigen than anaculture plus alum (F.C.P.) when either one or two doses were given. In the group receiving the activated antigen none had less than 1 unit of circulating antitoxin per ml. 28 days after one injection. Although no sample was taken 14 days after the second injection when the peak of the immunity might be expected, a consideration of the values of the samples taken at 7 and 15 weeks subsequently, indicates the exceptional titres which must have been achieved, particularly with the activated antigen. Evidence of this increase in antigenic efficiency of *Cl. welchii* type D toxoids by treatment with trypsin has already been given (Batty & Glenny, 1948).

Table II

Antitoxin Response of Two Groups of 20 Sheep to two doses of 5 ml. of F.C.P. (*Cl. welchii* Type D anaculture + alum) and T.T.P. (*Cl. welchii* Type D alum precipitated activated toxoid)

Units ϵ antitoxin per ml.	Numbers of sheep with given antitoxin titres: Before first injection of		28 days after first injection of		7 weeks after third injection of		15 weeks after second injection of	
	F.C.P.	T.T.P.	F.C.P.	T.T.P.	F.C.P.	T.T.P.	F.C.P.	T.T.P.
*<0·01	4	2						
0·01-0·02		3						
0·02-0·05	1		2				1	
0·05-0·1	3	2			1		1	
0·1-0·2	6	4	1		1		1	1
0·2-0·5	4	6			2		11	2
0·5-1·0	2	1	1		1		3	2
1·0-2·0		2	1	1	2	1	2	1
2-5			6	3	12	1	1	8
5-10			4	1		13		3
10-20			4	6	1	3		1
20-50			1	8		2		2
50-100				1				
Geometric means of each group in units per ml.	0·09	0·12	2·7	14·5	1·65	8·1	0·37	2·7

* For the purpose of calculating the geometric mean 0·01-0·02 is regarded as the geometric mean between the two, *i.e.*, 0·0141 and so on, and less than 0·01 is regarded as 0·007.

The results from the Ross-on-Wye flock given in Table III confirm those given in Table II, although here we see the lower responses which would be expected in a flock which had little or no basic immunity. These results also show the improvement in antigenic efficiency due to the addition of alum to the prophylactic.

In view of these results an extended trial was made using the Beckenham flock, a group of sheep of known history without natural immunity, and a type of population which might well be representative of the majority of flocks in this country that must be catered for by any prophylactic. The results in Table IV (also shown diagrammatically in Fig. 1) confirm the previous findings; that alum precipitated activated toxoid is a more efficient antigen than either anaculture or anaculture plus alum, and further that it is more efficient than unactivated alum precipitated toxoid. It is notable that none of the sheep which were injected with the activated antigen had less than 0·1 unit of antitoxin per ml. even 10 weeks after the second injection (Table IV) or 15 weeks after the second injection (Table II).

The advantage of using an activated antigen is still more clearly seen when the dosage is lowered. The results in Table V (also Fig. 2) indicate that if a good activated antigen is used a dose of 2 ml. can be expected to give a high level of circulating antitoxin even in sheep with little or no natural immunity. Six weeks from the time of the second injection the amount of circulating antitoxin was still far greater than the highest value attained after the injection of the usual prophylactic dose of pulpy kidney serum.

The results in Table VI (also Fig. 3) show that 33 weeks from the date of the second injection in the Newcastle upon Tyne

Legends

Fig. 3.—Comparison of the amount of antitoxin remaining 33 weeks after the second injection of F.C.P. and T.T.P. and the response to a boosting dose of these antigens.

A.—Geometric means of antitoxin titres remaining 33 weeks after the second of two injections of F.C.P.

B.—Geometric means of antitoxin titres remaining 33 weeks after the second of two injections of T.T.P.

C.—Geometric means of antitoxin titres 14 days after a boosting dose of F.C.P.

D.—Geometric means of antitoxin titres 14 days after a boosting dose of T.T.P.

Table III

Antitoxin Response of Three Groups of Sheep receiving two doses of 5 ml. of F.C. (anaculture), F.C.P. (alum precipitated anaculture) and T.T.P. (alum precipitated activated toxoid)

Units ϵ antitoxin per ml.	Number of sheep with given antitoxin titres: Before first injection of F.C.	F.C.P.	T.T.P.	28 days after first injection of F.C.	F.C.P.	T.T.P.	14 days after second injection of F.C.	F.C.P.	T.T.P.
<0·01		12	13						
0·01–0·02		3		3					
0·02–0·05		3	1		1	1			
0·05–0·1		1	2						
0·1–0·2			2	1			1		
0·2–0·5			1	3	2		1		
0·5–1·0				2	5	3			
1·0–2·0		1		3	4	3	10	2	
2·0–5·0				8	6	2	2	5	4
5·0–10				3	1	5	3	5	3
10–20				1	1	3	2	4	4
20–50						2	1	4	7
Geometric means of each group in units per ml.				1·0	1·3	3·4	2·4	7·6	12·3

FIG. 1.—Comparison of the responses of comparable groups of sheep to one and two doses of formalised culture (F.C.), alum precipitated toxoid (T.P.), formalised culture plus alum (F.C.P.) and alum precipitated activated toxoid (T.T.P.).

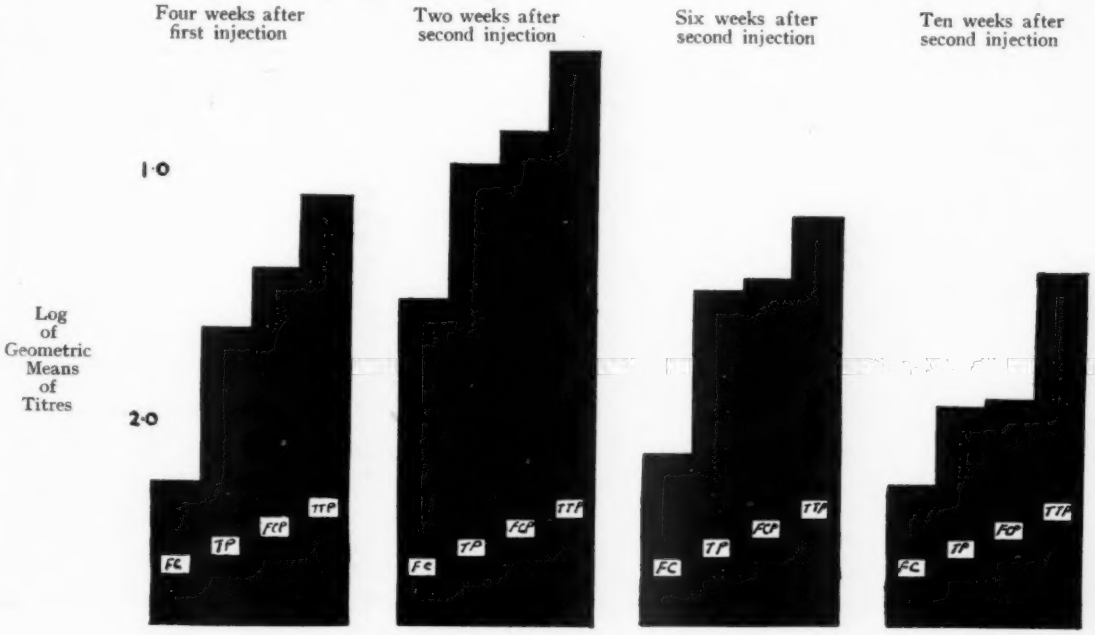

FIG. 2.—Comparison of the response of comparable groups of sheep to 5 ml. and 2 ml. doses of T.P. and T.T.P.

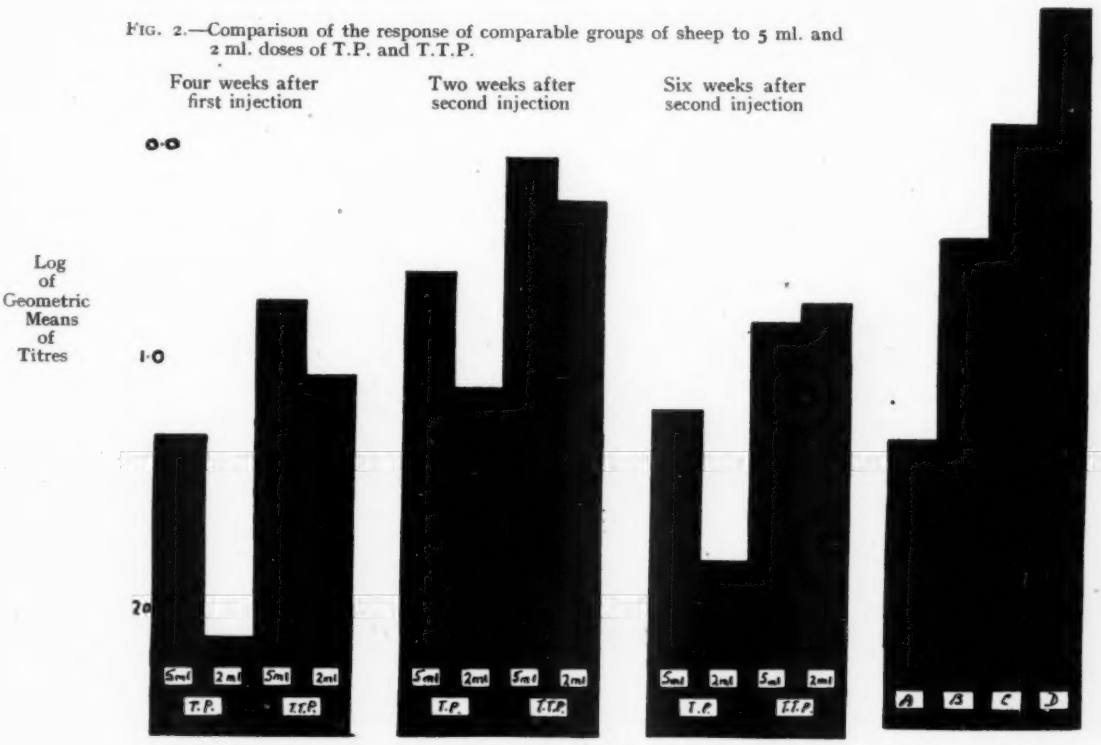

Fig. 3.

TABLE IV

ANTITOXIN RESPONSE OF FOUR GROUPS OF SHEEP TO TWO DOSES OF 5 ML. OF F.C. (ANACULTURE), T.P. (ALUM PRECIPITATED TOXOID), F.C.P. (ALUM PRECIPITATED ANACULTURE), OR T.T.P. (ALUM PRECIPITATED ACTIVATED TOXOID)

Units ε antitoxin per ml.	Number of sheep with given antitoxin titres																			
	Before first injection of				4 weeks after first injection of				2 weeks after second injection of				6 weeks after second injection of				10 weeks after second injection of			
	F.C.	T.P.	F.C.P.	T.T.P.	F.C.	T.P.	F.C.P.	T.T.P.	F.C.	T.P.	F.C.P.	T.T.P.	F.C.	T.P.	F.C.P.	T.T.P.	F.C.	T.P.	F.C.P.	T.T.P.
<0·01	7	9	8	8	5	2		1					1†				2	2	1	
0·01–0·02	2	1		1			1						3	2	1		2			
0·02–0·05	1								1				1				1			
0·05–0·1			1							1								1		
•																				
0·1–0·2					1	1			1									2	4	1
0·2–0·5			1		2	2	1		3	1	1		2	2	1	1	2	3	3	3
0·5–1·0					1	1	4			1				1	4	2	1			1
1·0–2·0					1†	2	3	3	3	1	3		2	1	1	1		2	1	2
2·0–5·0						1		4	1		2	1		4	2	3				
5·0–10						1				5	2	5								
10–20							1	1		1	1	2								
20–50											1†	(1 + 1†) 1†								
Geometric means of each group in units per ml.					0·055	0·34	0·67	1·60	0·47	2·3	3·4	8·9	0·079	0·54	0·63	1·3	0·054	0·14	0·17	0·67

• Indicates the level of circulating antitoxin above which the sheep should be protected.
† These sheep were not available for the later bleedings.

TABLE V

EFFECT OF VARYING THE DOSE OF T.P. (ALUM PRECIPITATED TOXOID) AND T.T.P. (ALUM PRECIPITATED ACTIVATED TOXOID) ON THE IMMUNITY RESPONSE OF COMPARABLE GROUPS OF SHEEP

Units ε antitoxin per ml.	Number of sheep with given antitoxin titres															
	Before first injection of				4 weeks after first injection of				2 weeks after second injection of				6 weeks after second injection of			
	T.P.		T.T.P.		T.P.		T.T.P.		T.P.		T.T.P.		T.P.		T.T.P.	
	5 ml.	2 ml.	5 ml.	2 ml.	5 ml.	2 ml.	5 ml.	2 ml.	5 ml.	2 ml.	5 ml.	2 ml.	5 ml.	2 ml.	5 ml.	2 ml.
<0·01	9	8	8	6	2	5	1						2			
0·01–0·02	1	1	1	2		2								1		
0·02–0·05				1										3		
0·05–0·1								1	1							
•																
0·1–0·2		1			1			1		1				3		
0·2–0·5				1	2	2		2	1	3			2	2	1	1
0·5–1·0					1			3	1	4			1		2	2
1·0–2·0					2		3	1	1	1		1	1		1	2
2·0–5·0					1	1	4	1		1†	1	4	4		3	4
5·0–10					1				5		5	2				1
10–20							1	1	1		2	3				
20–50											(1+1†) 1†					
Geometric means of each group in units per ml. ...					0·34	0·032	1·45	0·68	2·3	0·59	8·9	5·4	0·47	0·079	1·3	1·7

• Indicates the level of circulating antitoxin above which the sheep should be protected.
† These sheep were not available for the later bleedings.

flock the level of circulating antitoxin is still higher than at the beginning of the course of immunisation. The advantage still lies with the group vaccinated with the alum precipitated activated toxoid, none of these sheep having less than 1·0 unit per ml. The response to the boosting dose again emphasised the greater efficiency of this antigen.

SUMMARY

1. The immunity resulting from two doses of alum precipitated activated toxoid (T.T.P.) given at an interval of not less than four weeks is greater than that resulting from the same procedure using anaculture (F.C.), anaculture plus alum (F.C.P.), or untreated alum precipitated toxoid (T.P.) both in degree and in duration.

2. Although a higher level of immunity results from two 5 ml. doses of the alum precipitated activated toxoid a very satisfactory state of immunity was achieved by two doses of 2 ml. even in sheep without any natural immunity.

3. In a naturally immune flock a high level of circulating antitoxin was still present 88 weeks after immunisation.

4. In a previously well-immunised flock there is a clear indication that re-injection with an alum precipitated activated

TABLE VI

ANTITOXIN RESPONSE TO A BOOSTING DOSE OF 5 ML. OF F.C.P. (ALUM PRECIPITATED ANACULTURE), T.T.P. (ALUM PRECIPITATED ACTIVATED TOXOID)*

Units of ε antitoxin per ml.	Number of sheep with given antitoxin titres: Before — Boosting injection previously injected with F.C.P.	Before — Boosting injection previously injected with T.T.P.	14 days later — Injected with F.C.P.	14 days later — Injected with T.T.P.
0·05-0·1	1			
0·1-0·2	1			
0·2-0·5	3			
0·5-1·0	8	2		
1·0-2·0	1	2		
2·0-5·0	4	10	3	—
5·0-10·0	1	6		
10·0-20·0			2	1
20·0-50·0			4	3
50·0-100				5
>100				1
Geometric means of each group in units per ml.	0·30	3·2	12	30·5

* 33 weeks since last injected.

toxoid at six-monthly intervals will ensure that the animals always have a high level of circulating antitoxin.

Acknowledgments.—We should like to thank Mr. J. R. Hepple, B.Sc., of the Ministry of Agriculture and Fisheries, Veterinary Laboratory, Newcastle upon Tyne, and Mr. R. P. Morgan, M.R.C.V.S., of Ross-on-Wye, for carrying out the field work described in Experiments 1 and 2.

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CHANCELLOR CONGRATULATES BLOOD-STOCK BREEDERS

Lord Rosebery, President of the Thoroughbred Breeders' Association, in a letter to the Chancellor of the Exchequer regarding the recent sales of thoroughbred yearlings at Doncaster, said that the sales totalled 448,100 guineas. Many yearlings had been sold to non-residents in Great Britain, and the value of these came to more than 143,000 guineas. The purchase price did not include shipping and insurance rates, which had also presumably been paid in foreign currency.

Mr. Butler replied: "The foreign exchange earnings from the sales to buyers from other countries are most welcome, and the blood-stock breeders are to be congratulated on the results of their efforts to maintain and expand the export trade in thoroughbreds."

* * * * *

Worcester market has since August 10th been experimenting with new regulations designed to control the spread of swine fever. Worcester Small-holdings Committee were told recently that the experiment had been a complete success. Under the regulations no pig must be moved once it is penned in the market until it is finally removed from the site, and all pigs must be clearly marked with an indelible mark showing date of sale.

SENSITIVITY TO PENICILLIN OF ORGANISMS ISOLATED FROM CASES OF BOVINE MASTITIS

In vitro Tests on a Series of 500 Cultures

BY

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Since 1947 the various salts of penicillin have been widely used for the treatment of mastitis in dairy cows. The increasing use of this antibiotic was founded on many extensive clinical and bacteriological trials and at the same time several papers were published providing evidence on the *in vitro* sensitivity of various bacteria associated with bovine mastitis. Thus, Watson (1944), in a survey of the sensitivity of streptococci, included one group B and one group C from bovine mastitis cases and found them inhibited respectively by 0·06 and 0·01 unit per ml. penicillin in broth. Brownlee (1945) worked out the resistance of 16 strains of *Streptococcus agalactiae* in broth and milk media and found it to fall between 0·06 and 0·25 unit per ml. Murnane (1945) found that all the strains of staphylococci and streptococci from clinical cases which he tested were inhibited by 0·1 unit per ml. and could find no evidence of acquired tolerance in staphylococci as a result of repeated treatment. Watts & McLeod (1946) reported the sensitivity of 56 recently isolated strains of *Str. agalactiae* and four *Staphylococcus pyogenes* strains to be less than 0·04 unit per ml. in litmus milk. Heishman (1947) tested 150 cultures of mastitis organisms on blood agar and found the sensitivity to vary between 0·031 and 0·25 unit per ml. with the exception of *Bacterium coli* and two strains of staphylococci. Jennings (1947), examining bacteria of animal origin, found that most of the mastitis organisms were susceptible to penicillin with the exception of *Bact. coli*. Edwards (1949) studied 25 freshly isolated strains of *Str. agalactiae* in milk, and all of them proved sensitive to 0·1 or less unit per ml. Ford & Wilson (1952) assayed 281 pre-treatment cultures of *Str. agalactiae* and found no resistant strains ; 174 post-treatment cultures which were isolated at intervals of one, two and three weeks after treatment with penicillin were still sensitive.

There can be no question that the wide use of penicillin has been of great benefit in the treatment of mastitis, although bacteriologists and veterinary surgeons have realised that some types of infection respond more readily than others. *Str. agalactiae* undoubtedly is the most easily cleared infection and some of the streptococci such as *Str. dysgalactiae* and *Str. uberis* are fairly responsive. It is generally agreed that *Staph. pyogenes* is a rather more intractable problem, and—on theoretical and clinical grounds, the gram-negative pathogens such as *Bact. coli* are recognised to be resistant. However, more recently there has been an increasing tendency, particularly on the part of farmers and even some veterinary surgeons, to speak of the supposed increasing resistance of mastitis pathogens to treatment. These views have probably originated from medical work such as that published by Barber (1947a, b; 1948, 1949) which has clearly established that in human practice resistant strains are not infrequent. If these views are true in so far as they refer to bovine mastitis, it is obviously of some importance to check to what extent resistant strains are responsible for failures to eradicate infection. This survey was undertaken in an attempt to define how frequently resistant strains of bacteria occur in clinical cases of mastitis submitted for treatment. The samples tested were obtained mainly from cases prior to

treatment and the majority of them are from one veterinary practice. A few strains of organisms isolated from post-treatment samples have been examined and are included in the results. Obviously, if the views of those who believe resistance is increasing are correct, one would expect to meet an appreciable number of resistant strains occurring in mastitis cases before treatment.

Methods

Isolation of Organisms.—The milk samples were plated directly on to aesculin cow blood agar and crystal violet thallium acetate blood agar, in most cases within 24 hours of collection from the cow. Streptococci were identified by means of their biochemical reactions and their reactions to the streptococcal grouping sera (Lancefield technique). *Corynebacterium pyogenes* organisms were confirmed by culture on Loeffler slope, litmus milk and lactose serum water. *Staph. pyogenes* was tested for coagulase production. *Bact. coli* was identified by biochemical reactions.

Testing for Sensitivity.—A variety of methods are in use for testing the sensitivity of bacteria to antibiotics, and after a consideration of these it was decided to use a simple ditch-plate technique. This, it was considered, would use less time and equipment than the serial dilution method, but would pick out organisms which showed any appreciable resistance to penicillin. Any organisms falling into this class could then be tested in more detail.

The actual technique employed was to pick a random selection of 6 to 12 colonies from the pure culture of the freshly isolated organism, and this mixed subculture was incubated overnight in 0·05 per cent. glucose broth. The culture was standardised by opacity to a standard tube containing approximately 200,000,000 viable organisms. It was not considered necessary to control rigidly the number of organisms in the culture, since the inoculum used was large enough to pick out the resistant strains. The plates for assay were poured with 24 ml. amounts of nutrient agar containing 5 per cent. cow blood, giving a depth of 4 mm. A ditch 6 mm. wide was cut across the diameter of the plate and this was filled with blood agar containing 2 units per ml. crystalline sodium penicillin. Cultures to be examined were streaked with a platinum loop of 3 mm. diameter across the surface of the agar from side to side of the plate, at right angles to the penicillin ditch. A maximum of four cultures was put on one plate and each plate contained a control Oxford staphylococcus culture, similarly standardised. Plates were incubated overnight at 37° C. and the size of the inhibition zone measured with a millimetre rule.

The majority of the organisms showed a definite zone of inhibition, but a few, mainly staphylococci, were able to grow right across the penicillin ditch. Subcultures from the original cultures of those showing resistance on the ditch plate were grown overnight in 0·05 per cent. glucose broth for serial dilution assay. Serial dilutions of penicillin, commencing at 10 units per ml., were made in 0·5 ml. amounts of glucose broth, and equal quantities of the test culture, diluted 10^{-4}, were added. The tubes were incubated overnight and the results read as the smallest concentration of penicillin required to inhibit visible growth in the medium. A control set of tubes using the Oxford staphylococcus was put up with each batch of test cultures.

Results

The results given below were obtained over a period of 18 months from December, 1951, to May, 1953.

Table I
Results of Ditch Plate Sensitivity Tests
2 units penicillin per ml. in ditch

Type of organism	Number tested		Number resistant
	Pre-treatment	Post-treatment	
Str. agalactiae	122	4	—
Str. dysgalactiae ...	89	1	—
Str. faecalis	1	—	1
Str. uberis	98	—	2
Staph. pyogenes ...	111	5	11
C. pyogenes	58	2	—
Bact. coli	2	7	9
Total	481	19	23

Table II
Results of Serial Dilution Tests on Resistant Staphylococci and Streptococci

Type of organism	Reference No.	Conc. penicillin inhibiting growth (units per ml.)
Staph. pyogenes	55/14	0·15
	55/29	0·02
	55/41	0·15
	55/74	0·3
	56/93·187	2·5
	56/94·152	2·5
	56/95·377	2·5
Str. uberis	51/51	5·0
Str. faecalis	55/40	5·0

(A few cultures were lost before serial dilution tests could be done.)

Discussion

The results of the above examination confirm the experience of other workers that, with the exception of *Bact. coli*, the majority of organisms freshly isolated from cases of bovine mastitis are sensitive to quite small concentrations of penicillin when tested *in vitro*. The staphylococcal group has provided the largest number of resistant organisms, which to some extent falls into line with clinical findings and with reports in the medical literature. However, the organisms which have shown resistance on the ditch plates were not highly resistant when tested by the serial dilution method, and in fact some of them appeared relatively sensitive. This apparent discrepancy is due partly to the difference in technique and size of inoculum. As Barber (1947a) has pointed out, the concentration of penicillin required to inhibit resistant staphylococci *in vitro* depends to some extent on the number of organisms in the inoculum. Serial dilution tests carried out on some of the resistant strains isolated here, using different strengths of inoculum, have brought out this variation in sensitivity results, but even when a heavy inoculation has been used (500,000,000 viable organisms) the concentration of penicillin required to inhibit growth has never been more than 5 units per ml. This is a much lower level of resistance than that found by Barber (1947a) in some staphylococci isolated from hospital patients, which were able to grow in penicillin concentrations of 200 units per ml. when heavily inoculated. Only one of the post-treatment samples has produced a resistant organism, but with the general use of penicillin it is likely that many of the pre-treatment samples may have come from cows which have received penicillin on some previous occasion.

Summary

Five hundred cultures of bacteria freshly isolated from cases of bovine mastitis have been tested for penicillin resistance using a ditch-plate technique, the ditch containing 2 units per ml. of penicillin. Leaving out the strains of *Bact. coli*, 14 cultures were found to be resistant. When these 14 strains were tested by a serial dilution method the inhibiting concentration of penicillin fell between 0·02 and 5 units per ml. The results obtained by this survey show no evidence of increased resistance on the part of streptococci causing bovine mastitis as a result of the widespread use of penicillin in treatment, and no highly resistant staphylococci have been isolated.

Acknowledgments.—I am very grateful to Mr. D. L. Hughes, F.R.C.V.S., DIP.BACT. (LOND.), for his advice and assistance in the preparation of this paper. My thanks are also due to Miss J. Newell, who isolated and identified the organisms, and to Miss J. Blomfield and Miss K. Bastable for assistance with technical work.

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National Academy of Sciences—The Royal Society

United States (F.O.A.) Research Fellowships

In response to a request from the Organisation for European Economic Co-operation, the United States Government, through its Foreign Operations Administration, has provided funds of over $1,000,000 to enable 150 outstanding young scientists from Europe to travel to, and live in, the United States for up to two years in order to study and gain experience in American research institutions. By this means it is hoped to advance scientific research and to facilitate the adoption of the results of scientific research in production techniques. The funds are available in the first instance until the end of 1955. The National Academy of Sciences, Washington, is administering the scheme, and the Royal Society has accepted the invitation of the Academy to advise on the selection of candidates from the United Kingdom. Successful candidates, who will be required to undertake to return and resume scientific work in their own countries on completion of tenure of fellowships, will be placed in American universities to participate with American colleagues in current fundamental scientific research as closely as possible related to their own fields of interest. Most of their time will be spent working in this way, but opportunities may also be provided towards the end of the tenure of the fellowship for work on problems in industrial or other laboratories in applied research related to the fundamental research they have previously carried out.

About 25 fellowships will be open for award to candidates from the United Kingdom. No age limits are specified, but it is expected that most of the successful candidates will be between 26 and 32 years of age. Applications will be considered from candidates who propose to do research in the natural sciences and in the engineering, agricultural and medical sciences, but excluding clinical medicine. They must be in possession of a doctoral degree in science recognised in institutions of higher education, or have equivalent experience.

Applications, which may be made at any time, will be considered at regular intervals. For the first two sets of applications the closing date is November 30th, 1953. Forms of application and further detailed information are obtainable from the Assistant Secretary, The Royal Society, Burlington House, London, W.1.

[It is understood that the phrase "agricultural and medical sciences but excluding clinical medicine" may include aspects of veterinary and allied research.—*Editor.*]

EXPERIENCES WITH THE FEEDING OF PROCAINE PENICILLIN TO POULTRY

BY

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Introduction

During the past two years there have been numerous reports, mainly in the American literature, of the growth-promoting effect of antibiotics in the diets of pigs and poultry. The majority of these reports refer to poultry fed "all vegetable" rations. Reports from this country are fewer but similar effects have been reported by Coates *et al.* (1950a) on diets containing animal protein. Subsequently these workers (1951b) reported that penicillin supplementation of the diet produced no growth stimulus in poultry kept in new houses though similar birds on the same diet kept in old housing showed a marked improvement in growth rate following penicillin supplementation. They suggested that the old accommodation was infected with some "anti-growth" organism or organisms. This theory was further elaborated, Coates *et al.* (1952), and it was suggested that on most poultry farms this penicillin susceptible "anti-growth" infection would be present.

King & White (1953) as a result of their experiments concluded that given an adequate diet, young chicks do not benefit regularly from a penicillin supplement. They questioned the ubiquity of the "anti-growth" infection in old premises and suggested that further work was necessary before the existence of such an infection could be held to justify the widespread feeding of penicillin supplements.

This paper describes experiments carried out during the past 12 months. A preliminary experiment in which the birds have been allowed access to grass had shown no effect from the feeding of penicillin so it was decided to confine the experiments to birds under intensive conditions.

Four experiments are described, two closely supervised experiments and one large field trial with cockerels and a small practical trial with turkeys.

Materials and Methods

In all the experiments day-old birds were allotted at random to the different experimental groups and penicillin supplementation was started the same day. Procaine penicillin in a carrier of dicalcium phosphate was mixed with the mash at weekly intervals or more frequently if necessary. Control groups received carrier only. In the turkey experiment, where grain formed an increasing proportion of the diet, the concentration of penicillin in the mash was increased to maintain a constant concentration of penicillin per ton of total diet.

In the two closely supervised experiments on poultry about 30 birds were allotted to each group and kept in Morecote brooders for one month. In Experiment 1 they were then moved into intensive turkey pens (suitably altered) for a further 12 weeks, but in Experiment 2 the birds spent the next seven weeks in brooder pens, four or five birds per pen, and the last nine weeks in the intensive turkey pens.

The large field trial with cockerels was carried out at a large nearby poultry farm. Three groups of 170 day-old cockerels were used. One group acted as a control while two groups received penicillin supplements. The birds were kept

in brooders for five weeks, in open arks for a further four weeks, and for the final six weeks in batteries in groups of 10 birds.

In the turkey experiment the birds were kept in brooders under infra-red lamps for eight weeks after which time they were moved into intensive turkey pens raised off the ground.

In Experiments 1 and 2 the birds were weighed individually at weekly intervals, in the turkey experiment at fortnightly intervals. In the field trial the birds were only weighed individually at the end of the experiment.

RESULTS

Experiment 1.—The Effect of Penicillin on Diets with High and Low Levels of Fish Meal

As antibiotics have been reported as having greater effects on birds fed "all vegetable" diets it was felt worth while to see what effect penicillin would have on diets with differing levels of fish meal. Four groups of 30 Sussex × R.I.R. cockerels were used.

For the first eight weeks the birds were fed a chick mash and from 8 to 16 weeks a grower's mash. The rations of Groups I and II contained 10 per cent. of white fish meal while the rations of Groups III and IV contained 5 per cent. fish meal and sufficient vegetable protein to bring the total protein level to that of Groups I and II. Groups II and IV were given a supplement of 10 g. of procaine penicillin per ton. Details are given in Appendix I.

Table I

Effect of Feeding Penicillin to Cockerels on Diets with High and Low Levels of Fish Meal

	High level fish meal				Low level fish meal			
	Group I		Group II		Group III		Group IV	
	No penicillin		Penicillin		No penicillin		Penicillin	
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.
Average initial weight		1·53		1·61		1·5		1·53
Average weight—								
8 weeks	2	3	2	2	2	3·5	2	6
16 weeks	5	2·5	5	5	4	14·5	5	7
Improvement due to penicillin—								
8 weeks			-1				+ 2·5 oz. (7·0%)	
16 weeks			+ 2·5 oz. (3%)				*+ 8·5 oz. (10·8%)	
Food ratio†	4·685		4·552 (2·8%)		4·766		4·731 (1%)	

* Significant P < ·03 †Food ratio = Total food eaten / Total weight gained

The results in Table I show that on a diet low in fish meal the addition of procaine penicillin to the ration at the rate of 10 g. per ton of food produced a statistically significant increase in weight at 16 weeks, this improvement being about 11 per cent. The improvement in food ratio was insignificant. On the diet with a high level of fish meal the addition of the same amount of penicillin resulted in an improvement of only 3 per cent. which was not statistically significant. There was an improvement of 2·5 per cent. in the food ratio.

Experiment 2.—The Effect of Feeding Varying Amounts of Procaine Penicillin on the Growth of Cockerels

This experiment was designed to test the effect of varying the concentration of penicillin in the diet of cockerels. No special diets were used in this experiment, the birds being fed ordinary commercial National Poultry Foods. The levels of penicillin chosen were 0, 2, 4 and 10 g. per ton of food, one group of 30 day-old Sussex cockerels being allotted to each level.

For the first eight weeks the birds were fed on National Chick Mash after which they were changed to a grower's mash. From about the 12th week some birds in all groups began to show symptoms of "curly toe" and perosis and had to be destroyed.

As these symptoms suggested vitamin B deficiency 5 per cent. of dried yeast was added to the food from the 16th week, following which the incidence of symptoms dropped.

Table II

Effect of Varying Levels of Penicillin in the Diet of Cockerels

	Group I	Group II	Group III	Group IV
	No penicillin	Penicillin 2 g. per ton	Penicillin 4 g. per ton	Penicillin 10 g. per ton
Number of birds at start	30	30	30	30
	lb. oz.	lb. oz.	lb. oz.	lb. oz.
Average initial weight	1·3	1·3	1·3	1·3
Average weight—				
16 weeks	4 5·7	4 11	4 13·4	4 12·7
20 weeks	5 7·4	5 10·5	5 12·6	5 11
Improvement due to penicillin—				
16 weeks		5·3 oz. (7·6%)	*7·8 oz. (11·1%)	7 oz. (10%)
20 weeks		3·2 oz. (3·6%)	5·2 oz. (4·8%)	3·6 oz. (4·1%)
Food ratio, 16 weeks	6·68	6·25 (6·4%) +	6·36 (4·8%) +	6·27 (6·1%) +
,, 20 weeks	6·91	7·10	6·98	6·94

* Significant P < ·05 + = percentage improvement due to penicillin.

All the penicillin-supplemented groups show an improvement in weight as compared with the control group. At both 16 and 24 weeks the improvement on the 4 and 10 g. per ton is considerably less than twice that due to 2 g. per ton of penicillin, *i.e.*, 11·1 and 10 per cent. improvement as against 7·6 per cent. at 16 weeks, and 6 and 4·1 per cent. as against 3·6 per cent. at 24 weeks. At 16 weeks the improvement in food ratio is 6·4 per cent. for 2 g. per ton, 4·8 per cent. for 4 g. per ton and 6·1 per cent. for 10 g. per ton. There is no improvement at 24 weeks. The only statistically significant weight difference is between the controls and the 4 g. per ton group at 16 weeks. The reason is, probably, that the death rate in the groups had reduced the size of the groups to an extent such that the variation within groups was greater than that between groups.

Experiment 3.—Effect of Feeding Penicillin to Table Cockerels under Farm Conditions

This field trial was carried out on a large commercial poultry farm. Initially there were three groups, each of 170 day-old White Leghorn × R.I.R. chicks. For the first seven weeks they received National Baby Chick Mash after which they were changed over to a grower's mash (see Appendix II) for a further eight weeks. Groups II and III received a penicillin supplement of 2·5 g. procaine penicillin per ton of food.

TABLE III

EFFECT OF 2·5 G. PENICILLIN PER TON OF FOOD ON GROWTH OF COCKERELS UNDER FIELD TRIAL CONDITIONS

Live weights at 15 weeks

	Group I	Group II	Group III
	Controls	Penicillin	Penicillin
Average weight	3 lb. 9·7 oz.	3 lb. 14 oz.	3 lb. 13 oz.
Improvement due to penicillin: Average ...		4·3 oz. (7·3%)**	3·3 oz. (5·7%)**
		3·8 oz. 6·5%	
Food ratio	4·965	4·806 (3·2%) +	4·835 (2·6%) +

** P <·01 + =percentage improvement due to penicillin.

Both supplemented groups show a highly significant improvement over the controls averaging 6·5 per cent. There is also an improvement in food ratio of about 3 per cent.

EXPERIMENT 4.—EFFECT OF FEEDING PROCAINE PENICILLIN TO TURKEYS

This experiment was designed to test the effect of feeding procaine penicillin at the rate of 15 g. per ton of food to turkeys kept intensively on a normal commercial dietary regime. It was also used to compare two preparations of penicillin. Three groups of day-old birds were allotted as follows—Group I 27 birds, controls, Group II penicillin A 25 birds, Group III penicillin B 23 birds.

Chick crumbs and a small amount of green food were fed up to eight weeks. From then on grain was added to the ration in gradually increasing amounts until at 17 weeks it constituted 50 per cent. of the ration. At 22 weeks the grower's mash was changed to a finishing-off mash (see Appendix III). Groups I and II were kept to 24 weeks, Group III were killed off at 16 weeks.

TABLE IV

EFFECT OF FEEDING PROCAINE PENICILLIN TO TURKEYS

	Group I		Group II		Group III	
	No penicillin		Penicillin A		Penicillin B	
	lb.	oz.	lb.	oz.	lb.	oz.
Average initial weight ...		2		2		2
Average 16 weeks weight ...	8	6	9	14	10	7
Average 24 weeks „ ...	15	0	17	3	—	
Improvement due to penicillin—						
16 weeks			1 (17·9%)**	8	2 (24·6%)**	1
24 weeks			2 (14·6%) **	3		
Number of birds at finish	24		20		21	

* P <·05 ** P <·01

At 16 weeks both the penicillin preparations produced an improvement in weight, as compared to the controls, of about 20 per cent. These improvements were statistically significant while the difference between Groups II and III was not significant.

At 24 weeks the difference between the control group and the remaining penicillin group was about 15 per cent. but still significant.

These results can be broken down further to show the effect on male and female birds.

TABLE V

EFFECT OF FEEDING PROCAINE PENICILLIN TO MALE TURKEYS

	Group I		Group II		Group III	
Number of birds at finish	15		15		13	
	lb.	oz.	lb.	oz.	lb.	oz.
Average initial weight ...		2		2		2
Average 16 weeks weight	9	8	10	8	11	12
Average 24 weeks „ ...	16	13	18	7	—	
Improvement due to penicillin—						
16 weeks			1 (10·5%)*		2 (24%)**	4
24 weeks			1 (9·7%) +	10	—	

+ = P <·055 but >·05 * P <·05 ** P >·01

TABLE VI

EFFECT OF FEEDING PROCAINE PENICILLIN TO FEMALE TURKEYS

	Group I		Group II		Group III	
Number of birds at finish	9		5		8	
	lb.	oz.	lb.	oz.	lb.	oz.
Average initial weight ...		2		2		2
Average 16 weeks weight	6	9	8	1	8	7
Average 24 weeks weight	11	13	13	7	—	
Improvement due to penicillin—						
16 weeks			1 (23%)**	8	1 (28·6%)**	14
24 weeks			1 (13·8%)*	10		

+ = P <·055 but >·05 * P <·05 ** P < ·01

Tables V and VI show that the effect of penicillin A was greater on females than on males at both 16 and 24 weeks, though the difference between the two was less at 24 weeks. Penicillin B, on the other hand, produced improvements of the same order on both male and female birds. All the results at 16 weeks are statistically significant while those at 24 weeks are on the border line. In the male turkeys the difference between the two penicillins is significant at 16 weeks.

DISCUSSION

These four experiments all demonstrate that the addition of procaine penicillin to the diet of poultry kept under intensive conditions resulted in an improved rate of growth.

Apart from Experiment 1, all the birds were fed ordinary commercial rations containing about 10 per cent. of animal protein. In Experiment 1 an effect was observed only on the diet low in fish meal. The lack of effect observed on the high fish meal diet may be related to the fact that the amount of fish meal given provided a more than adequate supply of animal protein factor, as it has been shown that the feeding of antibiotics is greater in birds kept on all vegetable diets.

The results of Experiments 2 and 3 show that on commercial rations as little as 2 g. penicillin per ton of food will result in about 7 per cent. improvement in weight at 16 weeks. Increasing the amount of penicillin to 10 g. per ton only results in an improvement of up to 10 per cent.

The turkeys received a higher dosage of penicillin than the cockerels but here again there was a definite improvement. This improvement was greater than that seen in cockerels, of the order of 20 per cent. at 16 weeks. When the results are analysed in terms of sex it is found that female birds show a greater response than do the males. At 24 weeks, while there is still a considerable improvement in the treated birds, this is not so great as at 16 weeks. This is in accord with the view that the effect of antibiotics is an early growth.

In these experiments no particular effort was made to control the environment of the birds. All the accommodation has been used for some time and had been cleaned out some while before use, but no special effort was made to get rid of any infection. These results suggest that the addition of procaine penicillin at quite a low dose level will lead to greater gains up to 16 weeks than in unsupplemented birds.

King & White (1953) have suggested that on adequate diets young chicks do not benefit from penicillin supplementation. However, these results suggest that a response may be expected at 16 weeks, though there is some evidence that it then decreases.

Summary

Three experiments on cockerels, two closely supervised and one field trial, in which birds supplied with penicillin in their diet were compared with unsupplemented birds, are described. The results show that at 16 weeks of age an improvement in growth of up to 10 per cent. is obtained. In similar trials with turkeys an improvement of up to 25 per cent. was observed.

Acknowledgments.—We should like to express our thanks to Miss M. Norman for technical assistance, and Messrs. Bennett, Weller and W. & J. B. Eastwood for facilities; Mr. G. W. Cranch for preparing the supplements and to Mr. D. L. Hughes, F.R.C.V.S., DIP.BACT. (LOND.), for his interest.

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Appendix I

Rations Used in Experiment 1

Baby chick mash, 0 to 8 weeks

	Groups III and IV	Groups I and II
	Low fish meal	High fish meal
	Per cent.	Per cent.
Bran	16	20
Barley meal	15	15
Maize meal	26·5	26·5
Sussex ground oats	5	7
Fish meal	5	10
Dried skim milk	5	5
Earth nut meal	2·5	2·5
Dried grass	4·5	4·5
Dried Yeast	2·5	2·5
Steamed bonemeal	1	—
Mineral mixture	2	2
Soya bean meal	15	5
Total digestible protein	16·1	16·3

Mash, 8 to 16 weeks

	Low fish meal Per cent.	High fish meal Per cent.
Maize	15	15
Wheat	20	20
Oats	21	26
Barley	16	16
Broad bran	5	5
Dried grass	6	6
Fish meal	5	10
Pea meal	4	—
Soya bean meal	6	—
Minerals	2	2
Total digestible protein	13·4	13·4

Cod-liver oil added to all rations

Appendix II

Mash used from 7 to 15 weeks in large field trial on cockerels

Meat and bone meal	1	cwt.
Best grass meal	½	,,
Fine bran	2	,,
Maize meal	1	,,
Coarse bran	2	,,
Mixed corn	8	,,
Barley meal	4	,,
Fish meal	1	,,
Bone flour	14	lb.
Limestone flour	35	,,
Salt	7	,,
Distafeed B_2 (Riboflavin 2·27 g. per lb.)	1	,,
Distafeed B_{12} (vitamin B_{12} 6·8 mg. per lb.)	1	,,

Appendix III

Ration used in turkey experiment

Home-grown cereals		
Wheat 2 Oats 1 Barley 1	3	cwts.
Maize Meal	1	,,
Fine bran	½	,,
Grass meal	½	,,
Fish meal	½	,,
Meat and bone meal	½	,,
Liver	½	,,
Ground nut meal	½	,,
Mineral mixture	14	lb.
Cod-liver oil	14	pts.

LEGAL NOTES

Leicester Man Fined for Illegal Practice

At Leicester Magistrates' Court on September 7th, John Reginald Ronald Roberts, of 81, Highcross Street, Leicester, appeared on four summonses alleging contravention of the Veterinary Surgeons Act. He admitted posing as a registered veterinary surgeon and using the letters "M.R.C.V.S." after his name, and after hearing the evidence the Bench fined him a total of £21, plus £5 5s. advocate's fee and £1 costs.

Roberts admitted he was not a registered veterinary surgeon, that he treated a dog, held himself out to be a qualified V.S., and prepared to practise on a cat; had used the words "Canine Infirmary" at his premises, and used the initials "M.R.C.V.S." after his signature. In each case he was fined £5 5s.

"Many cases of serious suffering have resulted from the administrations of unqualified men. The purpose of these proceedings is to stop this practice," said Mr. D. S. Hunt, prosecuting. A Mr. T. Day (reports the *Leicester Mercury*) visited Roberts' premises with his dog, which had a cut eye, said Mr. Hunt, and asked him if he would treat it. Roberts said he would. When Mr. Day returned two days later the cut was still open. Apparently it had been stitched and some yellow powder was put on the eye. "The prosecution is not able to prove the stitches were done by the defendant, and he will say he did not do the stitching," Mr. Hunt continued.

"The advert., 'Canine Infirmary,' in the window of the premises, was to make people believe he had qualifications."

Mr. Hunt said Roberts took a cat from a Mr. W. H. Austin for treatment.

In a letter to a firm of manufacturing chemists Roberts used the letters after his name.

In Roberts' defence Mr. R. Tate said the establishment in Highcross Street was set up as boarding kennels rather than a place of treatment. Minor ailments cropped up. "Where surgery was required, and the use of implements necessary, he did not, in fact, attempt it. He took those cases to a qualified veterinary surgeon," said Mr. Tate.

Of the letter to the chemists, Mr. Tate said "It was swank. The letter was not addressed to any member of the public."

Mr. Tate said the offences were technical ones rather than an attempt by Roberts to hold himself out as a qualified surgeon.

CLINICAL COMMUNICATION

HEMLOCK POISONING IN CATTLE

RICHARD H. C. PENNY, B.V.SC., M.R.C.V.S.
LEIGHTON BUZZARD

The following account of poisoning by spotted hemlock (*conium maculatum*) which occurred on a dairy farm during the years 1950 to 1953 is thought worthy of record owing to the shortage of information on this condition in the literature.

Pharmacology.—The plant contains a number of alkaloids, chief of which is a volatile oil, coniine. The alkaloid has two actions ; firstly, like nicotine, it stimulates and later paralyses all ganglionic cell stations and, secondly—the most important action—it paralyses voluntary motor end-plates. These several actions may account for the very varied symptoms described below.

History of First Outbreak.—The farm covers 270 acres of low-lying heavy land, carrying a pedigreed dairy Shorthorn herd of some 200 cows and followers. All ditches and main brooks were dredged towards the end of the second world war. The sludge and soil removed from these ditches was spread over the land for about 15 feet on either side of each ditch and a mixed growth of weeds and nettles grew upon it. The farm, being attested, is double fenced with stakes and two strands of wire, and all smaller ditches have been fenced off to prevent cattle drinking from them. This ground has been farmed by the same family for 26 years and apparently there was no trouble until 1950.

In May of that year the writer was called to examine four cows with acute diarrhoea ; some colic was shown and blood was present in the faeces. Temperatures were normal. Milk yields declined but symptoms were transient and milk production was a little below its previous peak within 14 days. A tentative diagnosis of plant poisoning was made and a rough inspection of a 20-acre field was carried out. At one end of this field a considerable quantity of hemlock was growing along the bank of the ditch behind the wire ; in places this had been grazed to the ground despite the fact that there was ample spring grass in the field. Simple treatment was prescribed and involved dosing with salts and the administration of a stomachic. In this field all the hemlock was cut twice during the summer months and no further cases occurred.

History of Second Outbreak.—On June 3rd, 1951, the writer was called to the same farm to examine a 12-month-old Shorthorn bull which had been grazing in a 50-acre field in the company of a group of heifers, dry cows and bullocks. This animal, which was now recumbent, had been purchased from the South three weeks previously and had been turned out in excellent condition on May 25th, 1951. On June 2nd, 1951, the owner found him a little unsteady on his legs and noticed that he had lost a lot of condition despite the fact that there was little work to do amongst this bunch of cattle.

The bull was lying away from the other cattle beneath a tree and there was a flattened area of ground around him, suggesting that he had been struggling. He was dull, grinding his teeth, slobbering and, when moved, walked with an arched back, marked inco-ordination and a very stiff gait behind. He continually knuckled at the fetlocks, brushed his two hind feet together and favoured his right hind leg. The pupils were not dilated ; if anything, they were contracted. He was walked to a loose-box where a further examination was made. Trembling was noticed in the hind leg muscles and a considerable loss of condition had occurred from the time that he was purchased. Temperature was 101° and pulse rate 90 per minute. Appetite was in abeyance.

Blood samples were taken and sent to Weybridge for biochemical examination, and a very tentative diagnosis of hypomagnesaemia was made. The bull was given by subcutaneous injection 1½ oz. of magnesium sulphate in 8 oz. water. This caused no improvement. The blood analysis showed calcium 9·8 ; magnesium 1·7 ; acetone normal ; inorganic phosphorus 5·5, and thus gave some support to the tentative diagnosis. Accordingly a further dose of magnesium sulphate was given on the following day, but no progress was made.

The pulse rate was now 100, temperature still normal ; the trembling covered neck, foreleg and hind leg muscles. It was noticed that on urinating, instead of dribbling urine from his sheath, it was ejected in spurts, without apparent difficulty, to within and past the region of his forelegs. The animal was still unsteady on his legs and the diagnosis of magnesium deficiency was altered to one of possible plant poisoning. A search of the field was made early the next morning and hemlock was found much grazed under the wire by the ditches and in the patches of nettles. A small quantity was taken to the farm and the bull, who was now eating a little grass, ate it with relish.

A full dose of magnesium sulphate was given in a considerable quantity of water and injections of Lepticol were given intramuscularly. Glucose was administered intravenously in an attempt to aid liver function.

After all the hemlock had been pulled and nettles cut he was turned out again into the same field.

Within a month the bull, who had made a good recovery, had re-poisoned himself. He had lost weight again, was stiff and trembling and was constipated ; all other animals in the field remained in good health. He was brought up, dosed with salts and recovered for the second time. His recovery was aided by the fact that the condition had not been allowed to progress as far as previously.

There was ample " keep " in the field and the other animals had not attempted to touch what little hemlock there was or, having been reared on the farm, had acquired a tolerance to it. This second attack interfered with the bull's growth and he grew to be a tall, narrow-chested animal.

During 1952 he was not turned out. Hemlock was both cut and sprayed with a proprietary selective weedkiller, which undoubtedly retarded the plant's growth.

History of Third Outbreak.—In 1953 further trouble occurred. Despite the attempts made to eradicate the hemlock, odd plants were now occurring well into the pasture, and these were pulled before the young stock were turned out, and the hedgerows were sprayed with selective weedkillers.

During May six cows developed severe colic and diarrhoea with slight haemorrhage. Their milk yields, after declining by more than three-quarters, gradually returned to somewhere near the pre-colic levels. Dosing with salts was carried out, then a simple stomachic was given. This seemed to accelerate recovery. Two churns of tainted milk were returned during this outbreak, possibly caused by hemlock as no other reasonable explanation could be found.

In another field a group of 20 yearling cattle were turned out during the middle of May. Seven of these developed diarrhoea, acute colic and lost condition very rapidly. They arched their backs ; there was some trembling of the hind leg muscles and a stiff gait. Although the field was thought to be free from hemlock, and the hedgerows had been sprayed, it was found that the wilted plants under the wire had been grazed by these yearlings. They were removed immediately and dosed with salts. (Faeces samples failed to reveal the presence of a worm infestation or Johne's disease.) Recovery was complete in three weeks.

Conclusions

The preceding accounts afford enough evidence to suggest

that the conditions being dealt with were due to hemlock poisoning. Symptoms would appear to be irregular and this might be due to the quantity and state of the plant consumed. Several points, however, stand out in these outbreaks :—

1. All cases occurred in late spring when plenty of food in a palatable form was available. (Text-books say the plant is eaten only when grass is scarce, *i.e.*, in dry summers.)

2. In the case of the bull there would appear to be some definite liking and even craving for the plant.

3. Young animals are more susceptible than adult stock.

I have noticed that in the area covered by this practice, hemlock is becoming a fairly common plant. On two other farms (also visited by the dredgers) a profuse growth has occurred on the banks of the ditches and this is being found difficult to eradicate. Store cattle on one farm have suffered from attacks of spring diarrhoea (aetiology uncertain) and the house milk supply has been tainted. Numerous hemlock plants were found that had been grazed by the stock. The Great Ouse Catchment Board are planning to revisit the area in the near future, and, in view of the experiences recorded above, it is felt that farmers and contractors should have the dangers involved pointed out to them so that more care can be taken over the disposal of the sludge.

ABSTRACTS

Allergic Dermatitis of the Horse*

The author describes a thorough investigation into a skin condition which is known in Australia as " Queensland Itch." This is a chronic, recurring, intensely irritating, superficial dermatitis which occurs especially in the region of the mane, withers and tail. It is similar to, if not identical with, conditions described in the literature as occurring in horses in other parts of the world including Europe. Lesions are evident in the early summer and continue until the cooler weather in autumn and then recur each year, though chronic cases carry lesions even in the winter. They are confined to the dorsal aspects except in severely affected animals when they may extend down the sides of the neck and body. In young animals the ears and tail may be the only areas affected. Pruritus is marked and the animal rubs affected parts on trees, etc., thus causing loss of hair and abrasions. No significant changes were found in the R.B.C. count, haemoglobin, red cell volume, sedimentation rate, coagulation time, serum calcium, blood glucose and blood copper of susceptible and non-susceptible animals. In susceptible animals the white blood cell, the eosinophil and the platelet concentrations were significantly higher during the summer than during the winter ; during the summer they were higher at 9 p.m. than at 3 p.m. Histologically the lesions showed a great concentration of eosinophils in the skin, and other changes. Larvae of *Onchocerca cervicalis* were sometimes seen in the section. Since other workers have stressed the importance of this larval worm, 282 horses were examined at *post-mortem* and 225 were found infested but only 74 had dermatitis.

The author explains why he was led to believe there was a hypersensitivity to some biting insect. Antigen was prepared from an undescribed species of Culicoides and injected intradermally. It gave consistently positive reactions in the susceptible animals and negative reactions in the non-susceptible. The distribution of this sandfly in the coastal area corresponds with the distribution of the dermatitis in horses. The insect was observed on horses only on the late afternoon and night and attacked the animal almost exclusively on the back line and ears. It was not seen and was rarely trapped in the winter.

When susceptible animals were stabled in an insectary from 4 p.m. to 7 a.m. lesions disappeared in three to four weeks and when the same animals were allowed to graze all day and night lesions appeared in three days. The histological picture after the intradermal injection of Culicoides antigen into susceptible horses or of histamine into non-susceptible horses was identical with that of the naturally occurring disease. Blood histamine concentration was constant in non-susceptible animals but was found to rise in affected animals when exposed to attacks by the sandfly and also after intradermal injection of antigen.

" Hapamine " (histamine azoprotein) was effective when used therapeutically and prophylactically. " Rucide " (50 per cent. " P " isomer DDT) used as a 1 per cent. aqueous solution and applied weekly as a spray prevented the disease and helped affected animals to recover. Antihistaminics were effective only when used in uneconomic quantities. Local application with them tended to allay irritation. S. J.

* * * * *

Equine Radiology*

The chief difficulties met in equine radiology are thickness of tissue and movement of the patient.

The author explains how these difficulties may be overcome, while using a low-power X-ray unit. By the judicious use of various X-ray film and intensifying screen combinations, exposure time can be reduced.

Three types of Ilford X-ray film and four types of intensifying screen are described, together with their advantages and disadvantages. A series of radiographs was taken using these types of film and screen in all possible combinations.

The purpose, advantages and disadvantages of grids are also reviewed.

The results are discussed and tabulated in detail and a series of X-ray plates illustrates various points in question.

Also included is a table recording a series of exposures producing satisfactory radiographs of the navicular bone of a six-year-old hunter.

L. C. V.

* **Allergic Dermatitis of the Horse.** Riek, R. F. (1953). Proc. Pt. 1. Int. Vet. Congr. Stockholm, 1953. Paper 146, section 4, pp. 664-669.

* **The Use of Film and Intensifying Screen Combinations to Reduce Exposure Time in Equine Radiology.** Hickman, J. (1953). *J. Roy. Army Vet. Corps* **24**. 44-49.

TURKEY CONFERENCE IN NORWICH

A turkey conference was recently held in Norwich at which papers were given on turkey farming, and included one by Professor G. T. Klein, of the University of Massachusetts.

A turkey quiz was held, a member of the panel being Mr. T. P. Duffy, M.R.C.V.S., of the Ministry of Agriculture.

A meeting on the future of the turkey industry terminated the proceedings on the second day under the chairmanship of Mr. Branston Hunt, Editor of *The Poultry Farmer*. The panel included Mr. Motley, of Andover, Mr. Peele, of Norwich, Professor Klein, of Massachusetts, and Dr. W. M. McKay, M.R.C.V.S.

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"Customers Can Complain: Cattle Can't."—This is Fougasse's telling design for the cover of the "Guide to Staff on Handling of Animals " recently issued by British Railways. Simplicity is the keynote of this well-illustrated brochure in the compilation of which such diverse bodies as the British Veterinary Association and U.F.A.W. have had a hand, and which forms a most useful supplement to the official regulations. We understand that the booklet is being issued to every railwayman whose duties include the handling of animals, and it is so full of useful hints for all situations and for dealing with all the usual species, that it should fulfil its aim of promoting the general welfare and humane treatment of animals in transit.

REPORT

Department of Agriculture, Cyprus. I.—Annual Report of the Chief Veterinary Officer (Mr. R. J. Roe) for 1952 ; II.—Annual Report of the Animal Husbandry Services for 1952 (Livestock Officer, Mr. K. L. Richards).]

I.—The report is written by Mr. R. J. Roe, O.B.E., M.R.C.V.S., Chief Veterinary Officer, with a section by Mr. R. W. Crowther, B.Sc., M.R.C.V.S., Veterinary Research Officer.

There has been no animal disease of any importance during the year. This happy state of affairs is no fortuitous occurrence but the result of a hard-fought campaign of preventive vaccination extending over more than 20 years. This year, for instance, over 540,000 sheep were vaccinated against anthrax and 52,000 sheep against blue tongue.

There have been no cases of bovine tuberculosis, brucellosis or variola, nor has there been any recurrence of ox warble fly, which pest was eradicated some years ago. Entero-toxaemia of sheep, however, is becoming more evident as the standard of feeding improves ; as also are ovine piroplasmosis and coccidiosis of sheep and goats. Fowl typhoid, fowl pox and avian spirochaetosis are endemic ; but the colony appears to be free of bacillary white diarrhoea and fowl plague. Newcastle disease has not been observed since 1950.

Dealing more specifically with anthrax, the Chief Veterinary Officer records that this disease was at one time the cause of very serious loss. Before improved measures for the disposal of carcases were instituted and annual vaccination of sheep and goats made compulsory, the annual loss from the disease amounted to 10 per cent., representing a cash value of £25,000 to £30,000. The annual loss to-day from anthrax does not exceed £200. The infection, however, still lingers in the soil. This was brought out when this year a goat, left unvaccinated because of advanced pregnancy, died of the disease in an area where annual vaccination of all flocks had been carried out for over 25 years. The vaccine used in Cyprus is prepared in the department's own laboratory from an avirulent strain from Onderstepoort Laboratory, South Africa.

Blue tongue is another disease which has been kept firmly in check by prophylactic vaccination. The vaccine is prepared in concentrated form at Onderstepoort and diluted in Cyprus shortly before use.

Coccidiosis is on the increase in sheep, but is being successfully treated with mepacrine. The few cases of the disease met with in cattle have been similarly treated. The same treatment has also been applied with success in rabbits, among which the disease can cause heavy losses.

Contagious pustular dermatitis in a more severe form than usual has occurred this year. Individual sheep showed severe ulcerative lesions on the buccal mucosa and a temperature of 105° F. As the disease advanced more characteristic lesions showed on the commissures of the lips and around the nostrils. The infection is transmissible to goats and young cattle. Q fever has been definitely established in the island. Work was continued to reduce the incidence of the sheep nostril fly (*Oestrus ovis*) in localised areas by means of intra-sinal injections of a 15 per cent. emulsion of tetrachlorethylene. The results of a small-scale trial have been encouraging.

In meat inspection the chief cause of condemnation has been hydatid disease. It is indeed rare to find adult cattle and sheep completely free of the infestation and a Government committee has been appointed to devise measures to reduce its incidence. Veterinary officers now supply tablets of arecoline acetarsol free of charge to dog owners. Cysticercosis in pigs and cattle is less frequent than formerly.

A veterinary hospital is established at Nicosia and it is hoped to provide similar facilities for the clinical treatment of animals at other principal towns.

Staff.—Mr. R. J. Roe, Chief Veterinary Officer, retired in November, but was re-engaged pending the appointment of a successor.

He leaves behind a lasting record of sound administration.

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II.—This report, written by Mr. K. L. Richards, N.D.A., N.D.D., C.D.D., Livestock Officer, is submitted as an appendix to the report of the Chief Veterinary Officer.

Stud stables are maintained by Government at seven different centres and good-type stud animals are issued on loan to farmers.

Pigs.—A pig-fattening experiment has been carried out on a large scale. The average food-conversion figure was 1 : 4·8, *i.e.*, 1 lb. live-weight gain for 4·8 lb. meal consumed. The Large White pigs imported in 1950 are continuing to thrive well under Cyprus conditions. This breed is largely used to cross with the Large Black and the progeny are very popular with local butchers.

Sheep.—Milking and breeding trials with Sardinian sheep are continuing at the Government stock farm and their output is measured against the local fat tail sheep. This year an average lactation yield of 291·8 lb., with a butter-fat content of 7·8 per cent. was recorded for this breed. This compares favourably with the recorded milk output of 120 lb. for fat tail sheep, with a butter-fat content of 8·2 per cent.

Cattle.—The Dairy Shorthorn continues to be the popular dairy breed in the island, although increasing interest is being shown in the Jersey breed, which has continued to do well under Cyprus conditions. Steps are being taken by the department to improve native cattle for beef production and stall fattening is being encouraged. The price of meat is high.

Goats.—The Damascus goat has proved the most suitable for Cyprus conditions. The British Saanen goats imported in 1949 have not acclimatised well in lowland areas.

Mule and Donkey Breeding.—Cyprus is noted for a high breeding standard in mules and donkeys. The Cyprus Government periodically imports good type Irish draught and thoroughbred stallions for crossing with local donkeys.

Poultry.—There are 500,000 birds in Cyprus, mainly of the indigenous strain. By means of widespread use of Rhode Island Reds the local breed of poultry is being improved. Egg production from local strains hardly ever exceeds an average of 70 to 80 eggs per bird a year. From the first cross with R.I.R. egg production is 120 to 150, and from pure R.I.R. 150 to 200. Turkey raising is now an important source of increased supplies of poultry meat ; and rabbits provide a valuable supplement to the fresh meat supplies of the island.

W. W. H.

"STILL A PLACE FOR THE FARM HORSE"

"How does a farm which was one of the first in Wiltshire to get rid of all its horses in the drive for mechanisation now come to have five of them?", asks the *Farmers' Weekly* in a recent issue, and proceeds: "The answer was given by the farmer, Mr. John Rowsell, at a conference on management and mechanisation organised by the Association of Agriculture in London.

"Costings to discover the cheapest form of transport around the farm, he said, revealed that the one cob which was then on the farm was costing only 3 per cent. of the lowest tractor figure. It was then decided to add power in the form of cobs rather than as small tractors. As a result they now had three cobs for the poultry section and one each for the pigman and shepherd."

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The South Devon Herd Book Society Council decided recently that while it offered no objection to the dehorning of steers it was not prepared to encourage the dehorning of females.

GOLDEN JUBILEE OF THE R.A.V.C.

Plaque to the Memory of James Ferguson Simpson, F.R.C.V.S.

UNVEILING CEREMONY AT ROYAL COLLEGE OF VETERINARY SURGEONS

On Friday, October 2nd, 1953, at the Royal College of Veterinary Surgeons in Red Lion Square, London, a memorial plaque, presented by the officers of the R.A.V.C., on the occasion of the golden jubilee of the Corps, was unveiled and dedicated in the Council chamber. It bears the inscription:

1903 1953

The Officers of the Royal Army Veterinary Corps, on the fiftieth anniversary of the granting of the Royal Warrant, have erected this plaque to the memory of James Ferguson Simpson, F.R.C.V.S., President 1895-96, *for his outstanding service on behalf of the Corps.*

A large number of invited representatives and members of the Simpson family were present, together with members of the Council. Preceded by a guard of honour (R.A.V.C.), Brigadier A. G. Heveningham, Director of the Army Veterinary and Remount Services, Brigadier J. J. Plunkett, Colonel Commandant, Royal Army Veterinary Corps, the Rev. Canon V. J. Pike, Chaplain-General to the Forces, and the President of the Royal College (Professor R. E. Glover), together with the Registrar, Mr. W. G. R. Oates, and the Mace Bearer, made their way to the dais.

Professor GLOVER extended a welcome to the assembly. He said that it was not his intention to speak about the part played by members of the Simpson family in the affairs of the Corps. That was a matter on which Brigadier Plunkett would speak. But he wished to say something about the highly honourable record of the family in the history of the Royal College. The plaque being dedicated was to J. F. Simpson, but he desired to call attention as well to two other Simpsons whose names had appeared in the roll of Presidents. The first of these was Sir Henry Simpson, who was a member of Council from 1871 to 1894, and was President in 1887-88. Henry Simpson was a man of very strong personality, fearless in expressing his opinions, and one who did a great deal for the College and for the profession. They were more concerned on this occasion, however, with J. F. Simpson, who was on the Council until 1912, and was President in 1895-96. He had recently been consulting the published records of the deliberations of the Council, and was impressed by the sound common sense which was shown by J. F. Simpson during his period of service. At the time of his presidency there were on the Council several men of very strong personality, Sir John M'Fadyean among them, and the fact that he was the highly successful President of such a Council was a tribute to his personality and calibre.

Finally he referred to their more recent colleague, Lieut.-Colonel P. J. Simpson, who was President 1937-38, and up to the time of his retirement was most actively interested in College affairs. He was beloved by everybody on the Council and did a great deal for his profession, both in the College and outside. They were all very pleased to see with them on that occasion Mrs. Simpson, who had played a large part in her husband's career.

Finally, on behalf of the Council, he expressed their sincere congratulations to the Corps on attaining the 50th anniversary of the granting of the Royal Warrant by Edward VII in October, 1903. There had always been a close association between the College and the R.A.V.C., many members of the Corps had played a distinguished part in the Council, and it was a great pleasure to see such a representation of the Corps on this ceremonial occasion.

Colonel Commandant Brigadier J. J. PLUNKETT followed with a brief address. The Corps was greatly indebted for its establishment to J. F. Simpson. They were told that it took him a number of years to persuade the Army authorities that it was necessary to form a Veterinary Corps. It was a tribute to his determination that he was able to conclude this in a matter of four years. Some people in similar enterprises had had to carry on for longer than that and at the end had achieved very much less. He recounted the difficulties of the early years of the Corps, and the way in which it was handicapped in various campaigns. But it would have been a great satisfaction to those who were responsible for bringing it into existence to learn what it had accomplished, especially in the first world war and, although not to quite such a great extent, in the second. The Corps had adapted itself to Army demands very successfully.

It had been felt that some commemoration of the great man to whom they owed so much should be made and that the appropriate place for its installation was the Royal College. On behalf of the Corps he thanked the President and Council for allowing them to have the plaque in their beautiful chamber and in such a prominent position. It was fitting that it should be in the place where J. F. Simpson accomplished so much.

After prayers by Canon Pike the plaque was unveiled and dedicated.

Brigadier HEVENINGHAM, in asking the President to accept the safe custody of the plaque, said that they were paying tribute to a colleague who had rendered outstanding service to the Corps. In honouring the memory of J. F. Simpson they were at the same time strengthening the bond which existed between the civil and military members of the veterinary profession. He requested the President, on behalf of the members of the Corps, serving and retired, to accept the custody of the plaque. Professor GLOVER, in doing so, said that the plaque would recall to those who sat in that chamber the memory of an inspiring leader, and remind them of the link between the Corps and the College.

Following the ceremony the company were entertained by the R.A.V.C. in the College common room which had been lent by the President and Council R.C.V.S.

CORONATION CAT SHOW

There was a record entry of 2,046, from 412 exhibits 193 exhibitors at the coronation championship show organised by the governing council of the cat fancy and held at the Royal Horticultural Society's New Hall on Friday of last week. Blues had the largest entries in cat and kitten classes, with creams and chinchillas well represented. As usual, the Siamese dominated the short-haired sections.

The best exhibit in the show was a long-haired golden-eyed white, Mrs. D. Herod's Champion Carrig Cracker; best short-haired exhibit and best short-haired kitten, a blue-point Siamese female, Dr. and Mrs. W. A. Groom's Banchor Blue Titania; best long-haired kitten, a blue male, Mrs. M. E. Crickmore's Thiépval Paragon; and best short-haired adult, a seal-pointed Siamese male, Mrs. K. Williams's Blue Hayes Foxey.

R.A.V.C. GOLDEN JUBILEE: UNVEILING OF J. F. SIMPSON PLAQUE

1903
1953
THE OFFICERS OF THE ROYAL ARMY VETERINARY CORPS. ON THE FIFTIETH ANNIVERSARY OF THE GRANTING OF THE ROYAL WARRANT. HAVE ERECTED THIS PLAQUE TO THE MEMORY OF
JAMES FERGUSON SIMPSON.
F. R. C. V. S. · · PRESIDENT 1895 – 96
FOR HIS OUTSTANDING SERVICE ON BEHALF OF THE CORPS.

REVIEW

The Popular Cocker Spaniel. By Veronica Lucas-Lucas. Pp. 150. Illus. 645. London: Popular Dogs Publishing Co., Hutchinson House, Stratford Place, W.1. Price 12s. 6d.]

The modern cocker spaniel was evolved at the beginning of this century, since when it has become one of the most popular breeds in the country. The name "cocker" we are told is derived from the word "cocking," which described a small gun dog used for woodcock shooting. However, this book is not only an eulogy of the cocker spaniel, but a workmanlike attempt to initiate the novice into the business, art, and science of breeding cocker spaniels. The favoured points of the modern cocker spaniel are well illustrated by photographs and line drawings, so that the novice is provided with a good idea as to the desired shape to which his dogs should conform. He is also given the detailed pedigrees of the champion dogs, to guide him in the purchase of his stud animals.

All aspects on the general care and maintenance of spaniels, individually and collectively, are adequately covered, and there is a chapter on the training of the spaniel as a gun dog, contributed by P. R. A. Moxon. The final chapter is devoted to the diseases of the spaniel, in which the lady author has confined her recommendations for treatment to the minor ailments, and advised the novice to seek professional advice for the other conditions.

Veronica Lucas-Lucas is a knowledgeable and successful breeder of cocker spaniels, and her book contains much useful and practical advice based upon her own experiences. There are some minor points to which exception might be taken, but these do not detract from the value of the book, which those who breed or keep cocker spaniels will find well worth reading.

NOTES AND NEWS

Diary of Events

Oct. 17th.—Meeting of the Biochemical Society in the Department of Chemical Pathology, Westminster Hospital Medical School, Horseferry Road, London, 11 a.m.

Oct. 20th.—Annual Dance of the Mid-West Veterinary Association, at the Grand Hotel, Bristol.

Oct. 21st.—Meeting of the Southern Counties Division, B.V.A., at Southampton (The Royal Hotel), 6 p.m.

Oct. 21st.—Meeting of the Royal Microscopical Society, Tavistock House South, Tavistock Square, London, W.C.1, 5.30 p.m.

Oct. 21st.—General Meeting of the South-Eastern Veterinary Association, B.V.A., at the Royal Star Hotel, Maidstone, 2.30 p.m.

Oct. 21st.—Meeting of the Section of Comparative Medicine, Royal Society of Medicine, at 1, Wimpole Street, W.1, 5 p.m.

Oct. 22nd.—Meeting of the East Midlands Division, B.V.A., at Thurgarton, 2.15 p.m.

Oct. 23rd.—Meeting of the Sussex Division, B.V.A., at Brighton (Old Ship Hotel), 2.30 p.m.

Oct. 23rd.—South Wales Division, B.V.A., Dinner-Dance at Porthcawl (Seabank Hotel), 7.45 for 8.30 p.m.

Oct. 28th.—Meeting of the Midland Counties Division, B.V.A., at Birmingham (Medical Institute), 2 p.m.

Oct. 29th.—Autumn Meeting of the North of Scotland Division, B.V.A., at Inverness (Station Hotel), 2.30 p.m.

Oct. 30th.—Joint Meeting of the Lincolnshire and East Midlands Division, B.V.A., at Grantham (The George Hotel), 2.15 p.m.

Oct. 31st.—Meeting of the Society of Women Veterinary Surgeons, in the Veterinary Hospital, Pembroke Gardens, Liverpool, 2.30 p.m.

Nov. 6th.—Meeting of the Yorkshire Division, B.V.A., in the Department of Agriculture, The University, Leeds, at 2.30 p.m.

Dec. 4th.—Annual Dinner and Dance of the North Wales Division, B.V.A., at Llandudno (St. George's Hotel).

R.C.V.S. Membership Examinations

Nov. 6th.—Pharmacology, etc. (Revised Syllabus), Written Examination.

Nov. 9th.—Pharmacology, etc. (Revised Syllabus), Oral and Practicals (London and Dublin).

Nov. 9th.—Animal Management Examination commences at Edinburgh.

Dec. 10th.—M.R.C.V.S. Written Examinations.

Dec. 11th.—M.R.C.V.S. Written Examinations.

Dec. 14th.—M.R.C.V.S. Oral and Practicals commence (Panels "A" and "B").

B.V.A. Council and Committee Meetings

The following are the arrangements for the next meetings, which will be held in London on Wednesday, Thursday and Friday, November 11th, 12th and 13th, 1953:—

Wednesday, November 11th
11.30 a.m. Parliamentary and Public Relations Committee.
2.0 p.m. Veterinary State Medicine Committee.

Thursday, November 12th
10.0 a.m. Organising Committee.
12.0 noon. Home Appointments Committee.
2.0 p.m. Finance Sub-committee.
2.30 p.m. General Purposes and Finance Committee.

Friday, November 13th
11.0 a.m. Council Meeting.

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Admission of Dead Casualty Animals to Slaughterhouses

Memo 3/Meat

Veterinary Certificates

In December, 1952, the Ministry of Food published Memo 3/Meat, a memorandum regarding the methods and criteria of meat inspection recommended by the Ministry for adoption by local authorities and their officers in England and Wales. It is based on certain recommendations contained in the report of the Interdepartmental Committee on Meat Inspection (1951) and supersedes Memo 62/Foods which was issued by the Ministry of Health in 1922.

The recommendations made regarding the admission of dead casualty animals to slaughterhouses are of great interest to practising veterinary surgeons. Paras. 3 and 4 of the memorandum refer and are reproduced in full:—

"3. No undressed carcase should be admitted to a slaughterhouse unless it is accompanied by a certificate given by a veterinary surgeon stating the reason for the slaughter of the animal and particulars of any drugs which, to his knowledge, had been administered to the animal and which might affect the carcase; provided that the undressed carcase of a sheep or lamb may be admitted to a slaughterhouse without such a certificate if it is accompanied by a written declaration given by the owner, or by the person in charge of the animal at the time of its death, stating the reason for the slaughter of the animal, and that it was not being treated by a veterinary surgeon and giving particulars of any drugs or medicines recently administered to the animal.

4. No dressed carcase should be admitted to a slaughterhouse unless either:—

(*a*) The carcase (with or without its organs and viscera) is accompanied by a certificate given by an authorised officer certifying that the carcase and its organs and viscera have been inspected and passed as fit for human consumption, or

(*b*) The carcase is accompanied by its internal organs and viscera (other than the intestines) and by a certificate given by a veterinary surgeon stating the reason for slaughter and particulars of any drugs which might affect the carcase which to his knowledge had been administered to the live animal."

The Ministry of Food has adopted these recommendations and dressed or undressed carcases are now admitted to Government slaughterhouses only when accompanied by the appropriate certificates.

Veterinary certificates are of value to the meat inspector in assessing the fitness of carcases and offals for human food and it is essential that the veterinary surgeon, having seen the animal, should state as fully as possible the reasons which have led him to recommend emergency slaughter. The certificate should say in every case whether or not drugs likely to affect the carcase have been administered before slaughter.

Where casualty animals are admitted to a slaughterhouse alive, the owners are not obliged to provide veterinary certificates but in practice comprehensive certificates, giving the result of *ante-mortem* examinations, are appreciated by meat inspectors and facilitate their subsequent judgment of carcases and offals.

No certificate should be given by the veterinary surgeon unless he has seen the animal alive, nor should it contain any expression of opinion as to the subsequent fitness of the carcase and offals for human food.

It is hoped that members of the profession will co-operate fully with the Ministry of Food and the local authority meat inspectors in their efforts to implement the recommendations contained in the new memorandum.

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International Veterinary Congress

We are now in a position to inform our readers that it was decided in Stockholm to hold the XVIth International Veterinary Congress in Buenos Aires in 1957.

In response to our enquiries we are informed that some delay has been experienced in circulating the Resolutions passed at the XVth Congress recently held in Stockholm. The English text is now ready, however, and it is hoped that it will shortly be in the hands of the Secretary of the British National Committee.

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PERSONAL

Adviser to Hereford Cattle Breeders.—Major Tom Hodgins, M.R.C.V.S., of Dolla, Co. Tipperary, has been appointed as Field Officer to pedigree Hereford cattle breeders in Ireland, the Hereford Herd Book Society announced last week.

Major Hodgins, who served with the British Army Veterinary Corps in India, Sudan and Malta, retired in 1938, after 22 years' service. He practised as a veterinary surgeon in the West Indies for six years.

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Ministry of Agriculture, A.H.D.: Veterinary Field Staff Changes.—Mr. H. Cremlyn Hughes, M.R.C.V.S., Veterinary Officer, has been transferred from Carlisle to Welshpool; Mr. A. D. Osborne, M.R.C.V.S., Assistant Veterinary Investigation Officer at Langford, Bristol, has resigned.

It is also announced that the Ministry's Divisional Office at Cupar moved to Clydesdale Bank Buildings, Cupar (Tel. Cupar 2157 and 2158), on October 14th, 1953.

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Births.—Lindley.—On October 3rd, 1953, at Jos, Nigeria, to Doreen (*née* Eggleton), wife of E. P. Lindley, Colonial Veterinary Service, a son—Roger Philip.

Parsons.—On October 6th, 1953, to Pamela, wife of W. G. Parsons, M.R.C.V.S., of Milric House, Church Road, Kessingland, Suffolk, a daughter—Rosemary Anne.

Thorne.—On September 27th, 1953, at Plateau Hospital, Jos, N. Nigeria, to Rosemary (*née* Brown Douglas), wife of A. L. C. Thorne, M.R.C.V.S., a daughter.

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R.C.V.S. OBITUARY

Holmes, Roger Parkinson, F.R.C.V.S., D.V.S.M. (Vict.), N.D.A., Captain late R.A.V.C., 3, Hillcrest Avenue, Highfield Drive, Fulwood, near Preston. Graduated Liverpool, July 14th, 1914; Fellowship February 19th, 1921. Died October 6th, 1953; aged 68 years.

Mr. R. P. Holmes, F.R.C.V.S., D.V.S.M. (Vict.), N.D.A.

An Appreciation

His many friends throughout the profession will receive with much regret the news of Mr. R. P. Holmes's death, which occurred at Preston on October 6th, following an operation. He had been in rather indifferent health for some years and the strain of the operation apparently proved too much for a heart which had already been subject to severe strain.

A native of Lancashire, Mr. Holmes qualified at the Liverpool University School and after experience of general practice he decided to enter the field of public health. He held appointments in Birmingham and Bolton and during the 1914-18 war served as an officer in the R.A.V.C. in France, where he held the rank of Captain. In 1938 he was transferred to the staff of the Animal Health Division of the Ministry of Agriculture and Fisheries, being stationed at Preston, where for some years he was Deputy Divisional Officer.

Although of a somewhat retiring disposition, Mr. Holmes was a particularly able veterinarian and he was held in the highest esteem in agricultural circles throughout Lancashire. Those of us who had the privilege of working with him as colleagues were fully appreciative of his many excellent qualities and of his sterling worth as a man. He was regarded as one of the leading authorities on meat inspection and his advice was often sought in this capacity when the benefit of his wide experience was freely available. He was for many years an examiner in Meat Inspection to the Royal Sanitary Institute, an appointment which he relinquished this year on account of failing health.

To his wife, his daughter, and his son, Geoffrey, who is a final year student at the Royal Veterinary College, London, we extend our sincere sympathy.

E. R. C.

The Late Captain T. Thomson, M.R.C.V.S.

In its issue of September 25th the *Derbyshire Times* makes reference as follows to the death of Captain Thomas Thomson, at Rhos-on Sea, reported with deep regret in these columns on September 26th: "Another link with the old 4th North Midland Howitzer Brigade was severed by the death on Saturday of Captain T. Thomson, who was Veterinary Officer with the Brigade during the latter half of the Great War.

"The Brigade eventually became the D/230 Brigade, Royal Field Artillery, and Captain Thomson was a familiar figure at the reunion dinners held in Derby between 1919 and 1939.

"Captain Thomson's younger son lost his life during D-Day operations in the World War."

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The Health of Farm Animals

Dr. W. R. Wooldridge's Address to the Institute of Corn and Agricultural Merchants

In the course of an address to the Congress of the Institute of Corn and Agricultural Merchants, Ltd., held at the Royal Agricultural College, Cirencester, on July 22nd, Dr. W. R. Wooldridge, M.Sc., M.R.C.V.S., F.R.I.C., Scientific Director of the Animal Health Trust, said that the prevailing economic conditions and the need for greater home production of food for human consumption had created a much greater demand for higher productivity. With that demand closer attention had naturally been given to the feeding of animals and to the influence of feeding upon health. "In this connection it is useful to define what good health in the farmer's view really means. Good health is that apparently constant state of an animal which leads to efficient working of all its parts and allows of maximum productivity. Those last two words are very important from the point of view of the livestock owner. If he is not getting good productivity then from his point of view the animal is unwell. . . . The state of 'good health' must not only be linked with the normal average of the particular species but when dealing with farm livestock the normal productivity of the individual herd and even the animal must be taken into account."

Probably the greatest advance that had taken place in our knowledge of nutrition of recent years was the realisation that successful feeding depended not only on the gross composition of a diet but also upon the nature of those substances—the micro-nutrients—present in small amount and how all these substances could stimulate or inhibit the working of the animal tissues and organs. Until quite recently the feeding of farm animals had been in advance of applied human nutrition to the extent that "balanced" rations had been given for many years to livestock. It was 20 years after farmers began that practice that the medical people extended it to the feeding of the human population. "Occasionally a member of the medical profession forgets this fact," Dr. Wooldridge continued, "and refers to 'the unscientific farmer.' For many years proper consideration has been given by farmers to the need for rations balanced from the point of proteins, carbohydrates and fats adequate in calorific or energy-producing value. Now, of course, the conception of balancing rations has gone much further. It is appreciated that increased yields require more of the essential nutrients but the capacity of the alimentary tract of the animal, despite the great increase in productivity, has remained practically the same. Increased yields can only be obtained, therefore, by improving the quality of the ration or by increasing the rate of its turnover. Much has been said about the necessity for indigestible fibre. A certain amount is undoubtedly necessary, but the need for it must not be exaggerated to the extent that material that is not digested robs the animal of valuable space which could be used for more valuable nutrients. With increasing yields roughage must be replaced more and more by concentrates."

Dealing with the essential provision of vitamins and minerals,

Dr. Wooldridge said that if a ration was to be truly balanced these nutrients must be supplied in suitable quantities to meet the particular needs of the animal geared to its own physiological plane or level of productivity. " The calorific value of the whole ration and adequate quantities of protein, fats and carbohydrates remain as important as ever, although even here further advances in knowledge have been made. Protein, for example, is no longer considered just as protein but as types of protein. Just as in rations generally attention has been transferred from quantity and gross balance to quality, so also quality rather than just quantity of protein has become important. Quality of protein, of course, is related to its potentiality for producing the right amino acids when it is digested. Certain amino acids are essential for particular animals and for particular processes. Isoleucine, which is essential to chicks if they are to grow and survive, is a simple example. A great deal has been heard about the value of animal protein as opposed to vegetable protein. The enhanced value of animal protein is in part related to its amino acid content, but it now seems that it may also be related to the presence of other factors or minor nutrients such as the so-called ' animal protein factor.' The mechanism of the action of this factor is not yet understood, but it seems to be related to vitamin B_{12} and may prove to be an essential ingredient of the mechanism necessary for the optimum utilisation of proteins in general or vegetable proteins in particular." The ideal combination of food proteins was clearly that which provided a balance of amino acids that could be used by the animal with minimum wastage. " It is of no advantage to the animal to have to break down amino acids either for the purpose of supplying energy or merely for the purpose of getting rid of those present in excess. It wants its amino acids almost solely for building up tissue, enzymes and other materials of the body. It can and should get all its energy from carbohydrates and fats. Its optimum supply will provide on digestion the right kind and number of the various amino acids it requires for these processes. Whilst this optimum is difficult to obtain the aim of the nutritionist is to get as near it as possible."

When animals were fed on the farm some consideration should be given to the chemical composition and nutritional quality of the crops that went into the ration. " The quality of crops changes with the conditions of growth, of reaping and of storage. These changes must be compensated for by adjusting the concentrates or feed supplements. That is one of the reasons why the manufacture of ' balanced rations ' and compound foods has grown up. A great service is rendered to the farmer by those manufacturers and merchants who possess the requisite knowledge and use it to provide well-balanced rations for farm livestock." There were difficulties in the situation: farmers naturally wanted to feed their animals as cheaply as possible and if they had a relatively expensive product and felt it was extra good, occasionally they might be tempted to dilute it with something else they happened to have on the farm. It was not at all unusual to find a farmer doing that, in spite of the fact that the whole balance of the food he had bought was thereby upset. Furthermore, it was not uncommon for a farmer, faced with some disturbance in his herd, to believe that purchased food had caused the trouble. " Cases are known where the reduced yield or state of mild ill-health was caused by the addition on the farm to a balanced ration of something which caused it to become unbalanced."

Another way in which food that was perfectly correctly balanced to begin with could lead to trouble lay in the fact that some constituents might deteriorate if kept under unsatisfactory conditions such as exposure to air or oxygen, or to damp. The most obvious example was the loss of activity of carotene or vitamin A content. A third cause of trouble, of course, could be the spoiling of the food during periods of storage by such external agencies as mould growth, insect infestation or bacterial contamination. The last-mentioned could be very serious. The fouling of foods by the excreta from vermin or, not infrequently, from the animals themselves, could lead to the spread of infectious diseases through a flock or herd. This applied particularly to salmonella infections but it also occurred with parasitic infestations such as coccidia. Too often the food itself was blamed when it was only the mechanical conveyer of infection, owing to mismanagement on the farm and not to the condition of the food as bought. Infection might, of course, be present in the purchased food on rare occasions, but that generally arose under a system of State buying, where political considerations to some extent came into the field. " It may be advisable from the point of view of national policy to purchase raw materials for animal feeding from countries which are heavily infected with diseases that are rare or absent in this country, but clearly this introduces a risk of infection here." A danger of indirect transmission of infectious disease might arise when foodstuffs were distributed in containers that were used repeatedly.

" Another danger which sometimes occurs in connection with feeding arises from the inadvertent inclusion in a balanced ration of a poisonous plant. That, obviously, is likely to be rare under manufacturing conditions on a large scale, but when small amounts are processed it has on occasions been a cause of trouble. There are other ways in which plant poisons can reach animals. For instance, there is the condition in Somerset and parts of Gloucestershire where the grass absorbs molybdenum from the soil and becomes itself poisonous, setting up that condition of ill-health known as teart. This is but one example of the fact that apparently healthy looking plants may have absorbed some poisonous substance from the soil. Selenium is another substance readily absorbed by plants, which later may cause trouble in animals. Other substances that may be present in plants cause trouble in a different way and these may be inadvertently included in manufactured feeding-stuffs. The action of these substances has come to light only in recent years. Although they are not in a strict sense poisonous they produce their ill-effects because they inactivate some essential metabolite within the animal. An example is phytic acid, which is present in various cereals. This substance puts out of action the calcium in the diet and so may lead to a condition of rickets despite the fact that the ration is apparently well balanced in its amounts of calcium, phosphorus and vitamin D. Another substance of this type is dicoumarol, which is present in fermented sweet clover. It can interfere with vitamin K and may therefore give rise to a condition in which blood does not clot. This group of anti-vitamins, as they are sometimes called, includes isoriboflavin, which interferes with the action of riboflavin or vitamin B_{12}, and meta-folic acid, which interferes with the vitamin folic acid."

To-day there was a greater appreciation of the value of minor nutrients in a diet and possibly this was related to high productivity. A diet might contain sufficient minor nutrients to supply the animal's needs at a certain level of production, but if that level was raised there might be a shortage. Many of these vitamins and minerals seemed to be essential components of the tools which the animal used: they were parts of enzymes or enzyme systems, the tools or machines of the living cells. " Like tools or machines they are, in fact, over a period of time used up and have to be replaced. They are vitally important in the working of all animals, but they must be particularly important to a high-producing animal. This may explain why many high-producing animals go down with some metabolic disorder, sometimes suddenly, at other times more slowly. It is possible that an animal can be fully satisfied with its supply of nutrients in a diet at a particular level of production, but that when the amount of food given is increased the higher productivity may reveal an imbalance in some micro-nutrient leading to ill-health. We might say that the pushing of productivity beyond certain limits, as yet undefined, may make an animal more disease-prone or disorder-prone,- just as people are occasionally described by insurance companies as having become accident-prone. Clearly this is a field of nutritional knowledge which needs investigation to-day."

Proper nutrition formed the foundation of the prevention of ill-health. Furthermore, foods sometimes carried protective agents. " The example that is most often quoted is colostrum, which is said to be essential to the new-born because it carries antibodies against certain pathogenic germs. Latterly we are trying to add protective agents to foods, as for instance with the inclusion of antibiotics in the rations. At first it was thought that these antibiotics had a direct growth-stimulating effect. Now, from work done in various places, many believe that the antibiotics really have a beneficial effect because they prevent certain micro-organisms commonly present in the animal from lowering its level of health and productivity. It is not yet possible to say with certainty whether either of these explanations is the right one. If antibiotics secure their effect by inhibiting micro-organisms, however, then there is a possible danger that over a period of time even with these very small doses organisms may arise that are resistant to particular antibiotics. That this is a danger that must be watched is illustrated by the major problem now facing the medical profession following widespread use of penicillin, namely, the growing number of patients in hospitals in this country that are proving to be penicillin-resistant."

The relationship between good and bad health was a complex one in which many factors played a part. . . . It was because of these inter-relationships and because of the care often necessary to make an accurate diagnosis that the veterinary surgeon on the farm, in considering cases of ill-health, made full enquiries about hygienic management, feeding and husbandry. " Contrary to what a farmer often concludes, these enquiries about food supplies do not automatically incriminate the food as a cause of the trouble. A veterinary surgeon may find himself uncertain as to the real cause of a disease and he may provisionally conclude that it is possibly associated with the feeding and so decide to suggest, perhaps as a temporary measure, that a change in the food be made. . . . A farmer will all too readily interpret such advice to mean that his purchased foodstuff is the direct cause of the disease. It is for this reason, amongst others, that I wel-

come the growing liaison between the veterinary profession and members of your industry; the two groups can with advantage work closely together in the third stage of animal ill-health, *viz.*, the stage of metabolic troubles. I hope this talk may help this co-operation a little."

DISCUSSION

In the course of the ensuing discussion the following were among the questions asked and answers given:—

Q.—Is there any relationship between vitamin B_{12} and amino acids for certain factors, as there is between, say, feathering and pantothenic acid? Is it so all through the vitamin B group?

A.—We cannot say there is a definite relationship of that kind, but there is evidence to suggest that the animal uses vegetable protein better in the presence of vitamin B_{12}. By and large, the B group of vitamins is associated with the oxidation mechanisms of the body tissues, *i.e.*, they seem to be associated with the changes supplying energy rather than with those of synthesis, except that these require energy.

Q.—Is anthrax more likely to be spread with paper bags than bessian or jute?

A.—There is no difference—it is entirely a question of infection and either can carry the spores of anthrax if they have come in contact with them.

Q.—Is there any scientific danger in over-feeding?

A.—There is a danger in over-feeding. If the food is available and palatable it is probable that some animals will over-feed.

Q.—Dr. Wooldridge has welcomed the liaison between the veterinary profession and our trade because he feels some good might come out of it. Could we suggest that further steps be taken on the veterinary side to see that more is taught in the veterinary schools to demonstrate that it is not the food in itself which is commonly associated with disease but possibly a combination between food and other factors, and that in discussing the matter on the farm the veterinary surgeon should be a little more careful than perhaps he is sometimes to see he does not give a wrong impression?

A.—We have to remember that the science of nutrition has advanced enormously during the last few years and there is always a time lag in knowledge getting from the research laboratory into actual practice. To-day nutrition is well taught to the veterinary student, but in the spread of this knowledge the nutritional experts in your trade can help. Nevertheless, just as you are in effect warning me as a veterinary surgeon not to pretend that I am a nutritionist, so I have to warn you not to pretend that you can diagnose disease. The greater one's knowledge of disease the more exacting does diagnosis become.

Q.—Is there a danger in using antibiotics except in backward animals?

A.—There is not adequate evidence from the scientific investigations in this country to prove that antibiotic additions to feeding-stuffs are an advantage to the really healthy animal. There is evidence, however, to suggest that the majority of our pigs are slightly sub-normal in that a high proportion of them are infected with a virus. Antibiotics seem to help with these animals as well as with the truly backward ones. There may be other dangers in the use of the antibiotics, as I have indicated in my paper.

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ADDRESSES OF DISEASE-INFECTED PREMISES

The list given below indicates, first, the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

ANTHRAX:

Lancs.—The Tannery, Lostock Hall, Nr. Preston (Oct. 7).

Northants.—Mill Field, London Road, Wellingborough (Oct. 6); Shelton Road Farm, Raunds, Wellingborough (Oct. 8).

Salop.—Henbarns Farm, West Felton, Oswestry (Oct. 7).

FOWL PEST:

Essex.—Westholme Poultry Farm, Hydewood Lane, Rochford (Oct. 6).

London.—2, Stormont Road, N.6 (Oct. 8).

Middx.—29, North Hyde Road, Hayes (Oct. 8).

Suffolk.—Glen Ayr, Mill Lane, Bradwell (Oct. 6); Long Acres, Mill Lane, Bradwell, Gt. Yarmouth (Oct. 8).

SWINE FEVER:

Ches.—Outwood Farm, Bolshaw Road, Heald Green, Cheadle (Oct. 7).

Cornwall.—Selwyn Stores, Perranwell Station, Truro; Lansalson Farm, Ruddlemoor, St. Austell (Oct. 10).

Essex.—Hole Farm, Stansted (Oct. 8).

Hants.—Bailey's Farm, Heckfield, Basingstoke (Oct. 7).

Kent.—Postley Farm, Maidstone (Oct. 9).

Norfolk.—Buildings Farm, Burgh St. Peter (Oct. 9).

Notts.—11, Victoria Street, Kimberley (Oct. 8).

Surrey.—The Nook, Hurtmore, Godalming (Oct. 9); 216, Ruxley Lane, West Ewell; Little Trundley Heath Farm, Shalford, Guildford (Oct. 10).

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PROBLEMS IN PROVIDING RATIONS FOR BRITAIN'S LIVESTOCK

MEETING OF THE NUTRITION SOCIETY

The Nutrition Society held a meeting, partly in the Northern Hotel and partly in the Rowett Research Institute, Bucksburn, on October 1st and 2nd. The gathering was well attended and was representative of many interests in this particular field, and included speakers such as Mr. Humphries, of the Ministry of Food, who has been largely responsible for the importation of feeding-stuffs since war began. He gave a review of the present position of imports and the future possibilities. High points in his paper were a present surplus of palm kernel cake, sunflower cake and copra cake as well as unextracted yeast. Apart from this, the position was uncertain and would tend to be even more so in the future. The discussion of this paper was opened by Dr. I. Leitch, of the Commonwealth Bureau of Animal Health.

Dr. Carpenter, of the Rowett Research Institute, gave a description of the value of various proteins and the importance of meeting the complete requirements for amino acids rather than protein standards.

Mr. Muir, of Messrs. Bibby's, and one time of the Royal Veterinary College, spoke on high energy rations for poultry, and the discussion on his paper was opened by Mr. J. K. Dow, M.R.C.V.S. Mr. Robertson, of Queen's University, Belfast, gave an interesting and topical paper on the value of synthetic vitamins and antibiotics in the diet of pigs and poultry. The discussion of this paper was opened by Dr. W. M. McKay, M.R.C.V.S.

Dr. J. Duckworth, of the Rowett Institute, presented a useful paper on economies in pig and poultry rations, his theme being that our standards have been too high in the past, and economies, especially in protein, are possible and necessary.

Mr. Holmes, of the Hannah Dairy Institute, gave a paper on the value of grassland in the feed of dairy cows, the discussion being opened by Professor A. Robertson, of the Royal (Dick) School of Veterinary Studies, University of Edinburgh.

The meeting was ultimately brought to a close on the second day by Dr. Eden—one of the Nutritional Chemists of the N.A.A.S. and at one time at the Veterinary Laboratory at Weybridge—who developed the theme of the difficulties and "hares" sometimes raised by well-intentioned stock-owners met by advisers in the field who were subsequently involved in the time-consuming task of clearing up misunderstandings over elusive or non-existent problems and also the difficulties of control of experiments on the farm.

W. M. McK.

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.

BOS BRACHYCEROS IN AFRICA

Sir,—With reference to Mr. Mills's letter in your issue of September 5th, there is an interesting article by Dr. R. G. Archibald in the *Annals of Tropical Medicine and Parasitology*, Vol. 21, p. 39, 1927, entitled "The tsetse fly belt in the Nuba Mountains Province of the Sudan." He deals with the small cattle of that region and their resistance to trypanosomiasis, which, in practice, would appear to amount to an actual immunity. His photos show cattle which are identical phenotypically with West African Shorthorn cattle in the Northern parts of the Northern territories of the Gold Coast, and which are quite definitely a fusion of the *Bos brachyceros* type and the Zebu. The country illustrated in the same photos is very similar to *G. submorsitans* country in West Africa. This type of cattle beast was termed "Sanga" by myself in my article "The West African Shorthorn Cattle" in *The Veterinary Record*, Vol. 63, No. 27, p. 454, of September 5th, 1951—a term coined by Messrs. Curson and Epstein for that particular type.

All the indigenous cattle of the Gold Coast are unhumped, but only a very small proportion are *Bos brachyceros per se*, and I have not found that these are intractable as is stated of the Nigerian "Muturu." The remainder are a fusion of the three great breeds of African cattle, the *Bos brachyceros*, the Hamitic Longhorn and the Zebu. Broadly speaking, the bigger the cattle the more Zebu in the make-up, while the more *Brachyceros* or Hamitic Longhorn the higher the anti-trypanosomiasis resistance. The factor of dwarfism appears in *Bos brachyceros* and to a lesser degree in the Hamitic Longhorn, breed type, N'Dama cattle, but disappears when the Zebu is introduced in crossing.

The photo of the adult Nuba bull in Mr. Mills's letter depicts an animal very similar to types found about 100 miles north of the Northern Gold Coast frontier, in French West Africa, where the incidence of trypanosomiasis is such that a larger admixture with the Zebu does not entail clinical trypanosomiasis. Is it possible that in the period between Dr. Archibald's article and Mr. Mills's observations tsetse fly has decreased in the Nuba mountains with less virulent trypanosomiasis and a consequent increase in the Zebu make-up of the cattle? This was the aim of all West African cattle owners, to secure a bigger and better animal through the fusion of the Zebu, as they were cognisant of the factor of dwarfism in the smaller breeds and wished to eliminate it in practice.—Yours faithfully, J. L. STEWART, P.O. Magoebaskloof, North Transvaal, South Africa. *October 1st*, 1953.